March 1957

Communications—Electronics—Photography

# SIGNAL



*Missile With Radar Beacon*

See Page 71

# DOTS

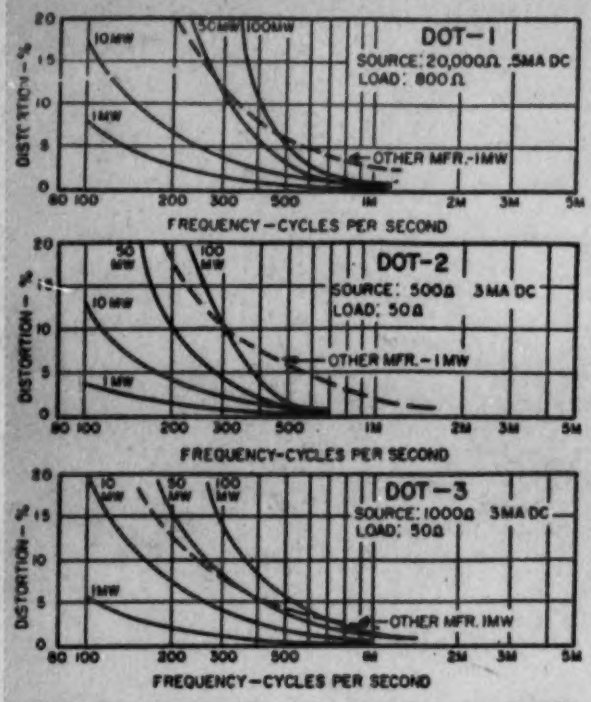
## Deci-Ouncer Transformers

REVOLUTIONARY TRANSISTOR TRANSFORMERS

of unequalled power handling capacity and reliability

### TYPICAL DOT PERFORMANCE CURVES

Power curves based on setting output power at 1 KC, then maintaining same input level over frequency range.




*DOT units have been designed for transistor applications

Conventional miniaturized transistor transformers have inherently poor electrical characteristics, perform with insufficient reliability and are woefully inadequate for many applications. The radical design of the new UTC DOT transistor transformers** provides unprecedented power handling capacity and reliability, coupled with extremely small size. Twenty-two stock types cover virtually every transistor application*. Special types can be made to order.

**High Power Rating** . . . up to 100 times greater.
DOT-1 has 5% distortion at 100 mw, other mfr. 6% at 1 mw.

**Excellent Response** . . . twice as good at low end.
DOT-3 is down 1 db at 200 cycles, other mfr. is down 4 db.

**Low Distortion** . . . reduced 80%.
DOT-1 shows 3% distortion where other mfr. shows 20%.

**High Efficiency** . . . up to 30% better.
DOT-1 has 850 ohm pri. resistance, 125 ohm sec.; other mfr. approx. 1200 and 200.

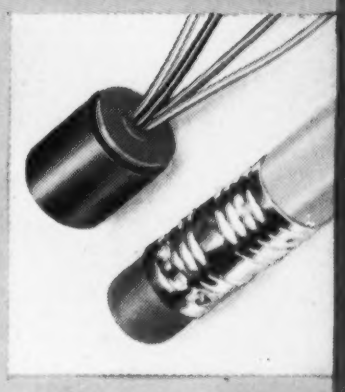
**Moisture Proof** . . . processed to hermetic specs.
DOT units are hermetic sealed compared to other mfr. open structures.

**Rugged** . . . completely cased.
DOT units can withstand all mechanical stresses.

**Anchored leads** . . . will withstand 10 pound pull test.
Lead strain completely isolated from coil winding.

**Printed Circuit Use** . . . plastic insulated leads at one end.
Other variations available.

1.3X ACTUAL SIZE



**DOT CASE**

Diameter . . . . . 5/16"
Length . . . . . 13/32"
Weight . . . . . 1/10 oz.

| Type No. | Application | Level Mw. | Pri. Imp. | D.C. Ma.‡ in Pri. | Pri. Res. | Sec. Imp. |
|---|---|---|---|---|---|---|
| DOT-1 | Interstage | 50 | 20,000<br>30,000 | .5<br>.5 | 850 | 800<br>1200 |
| DOT-2 | Output | 100 | 500<br>600 | 3<br>3 | 60 | 50<br>60 |
| DOT-3 | Output | 100 | 1000<br>1200 | 3<br>3 | 115 | 50<br>60 |
| DOT-4 | Output | 100 | 600 | 3 | 60 | 3.2 |
| DOT-5 | Output | 100 | 1200 | 2 | 115 | 3.2 |
| DOT-6 | Output | 100 | 10,000 | 1 | 1000 | 3.2 |
| DOT-7 | Input | 25 | 200,000 | 0 | 8500 | 1000 |
| DOT-8 | Reactor 3.5 Hys. @ 2 Ma. DC | | | | 630 | |
| DOT-9 | Output or driver | 100 | 10,000<br>12,500 | 1<br>1 | 930 | 500<br>600 |
| DOT-10 | Driver | 100 | 10,000<br>12,500 | 1<br>1 | 930 | 1200<br>1500 |
| DOT-11 | Driver | 100 | 10,000<br>12,500 | 1<br>1 | 930 | 2000<br>2500 |
| DOT-12 | Single or PP output | 500 | 150 CT<br>200 CT | 10<br>10 | 11 | 12<br>16 |
| DOT-13 | Single or PP output | 500 | 300 CT<br>400 CT | 7<br>7 | 20 | 12<br>16 |
| DOT-14 | Single or PP output | 500 | 600 CT<br>800 CT | 5<br>5 | 43 | 12<br>16 |
| DOT-15 | Single or PP output | 500 | 800 CT<br>1070 CT | 4<br>4 | 51 | 12<br>16 |
| DOT-16 | Single or PP output | 500 | 1000 CT<br>1330 CT | 3.5<br>3.5 | 71 | 12<br>16 |
| DOT-17 | Single or PP output | 500 | 1500 CT<br>2000 CT | 3<br>3 | 108 | 12<br>16 |
| DOT-18 | Single or PP output | 500 | 7500 CT<br>10,000 CT | 1<br>1 | 505 | 12<br>16 |
| DOT-19 | Output to line | 500 | 300 CT | 7 | 19 | 600 |
| DOT-20 | Output or matching to line | 500 | 500 CT | 5.5 | 31 | 600 |
| DOT-21 | Output to line | 500 | 900 CT | 4 | 53 | 600 |
| DOT-22 | Output to line | 500 | 1500 CT | 3 | 86 | 600 |

‡DCMA shown is for single ended useage (under 5% distortion—100MW—1KC) . . . for push pull, DCMA can any balanced value taken by .5W transistors (under 5% distortion—500MW—1KC)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BPA

# SIGNAL

***Communications-Electronics-Photography***

Journal of the Armed Forces Communications and Electronics Association

**VOLUME XI** **MARCH 1957** **NUMBER 7**

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### *Features*



### *Departments*



*Authors are entirely responsible for opinions expressed in articles appearing in AFCEA publications, and these opinions are not to be construed as official or reflecting the views of the Armed Forces Communications and Electronics Association.*

*What does it do between*

# HERE and . . .

# THERE?

*For the first time the behavior pattern of a free space Moving Target can be directly calibrated and immediately evaluated!*

The proof of any guided missile is its performance. Not only is it necessary to provide accurate trajectory data in order to determine its effectiveness, but this must be made immediately available.

To meet both requirements is the purpose of the AN/FPS-16 instrumentation radar. This is the first radar developed specifically for Range Instrumentation. It has demonstrated its ability to track with accuracy in darkness, through clouds—under any atmospheric conditions—over extended ranges, and to yield data that can be reduced almost instantaneously to final form. This unit can also be assigned to plot performance of missile, satellite, drone and other free space moving targets.

In the past, this data has depended upon optical devices, triangulation systems with long base lines and precision limitations, modified radar equipment and data reduction methods often requiring months for computation. The immediate availability of data evaluation provided by the AN/FPS-16, now being built by RCA under cognizance of the Navy Bureau of Aeronautics for all services, is a great forward step in Range Instrumentation.

RCA Tmk(s)®

*Defense Electronic Products*

**RADIO CORPORATION of AMERICA**

*Camden, N.J.*

# PRECISION DEPTH RECORDER

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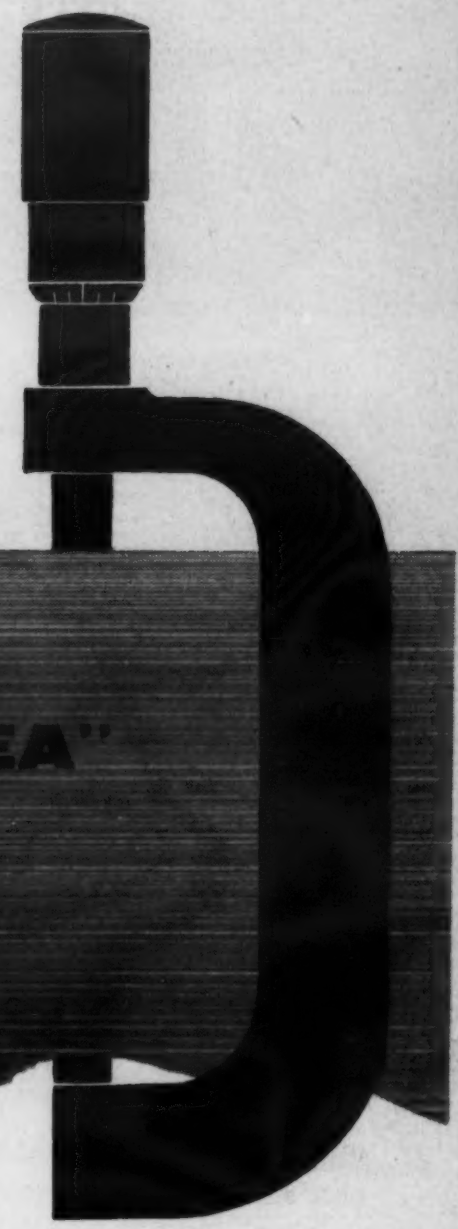
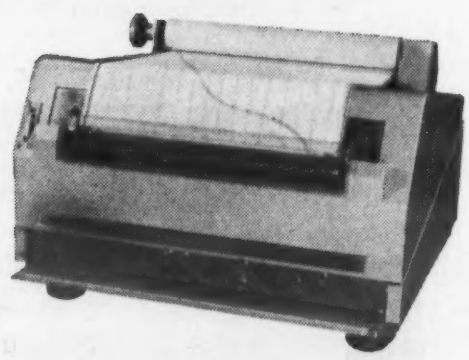


**"MICROMETER OF THE SEA"**



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- **PRECISION ECHO TIMING**
  Less than 1 Fathom Error in any Depth
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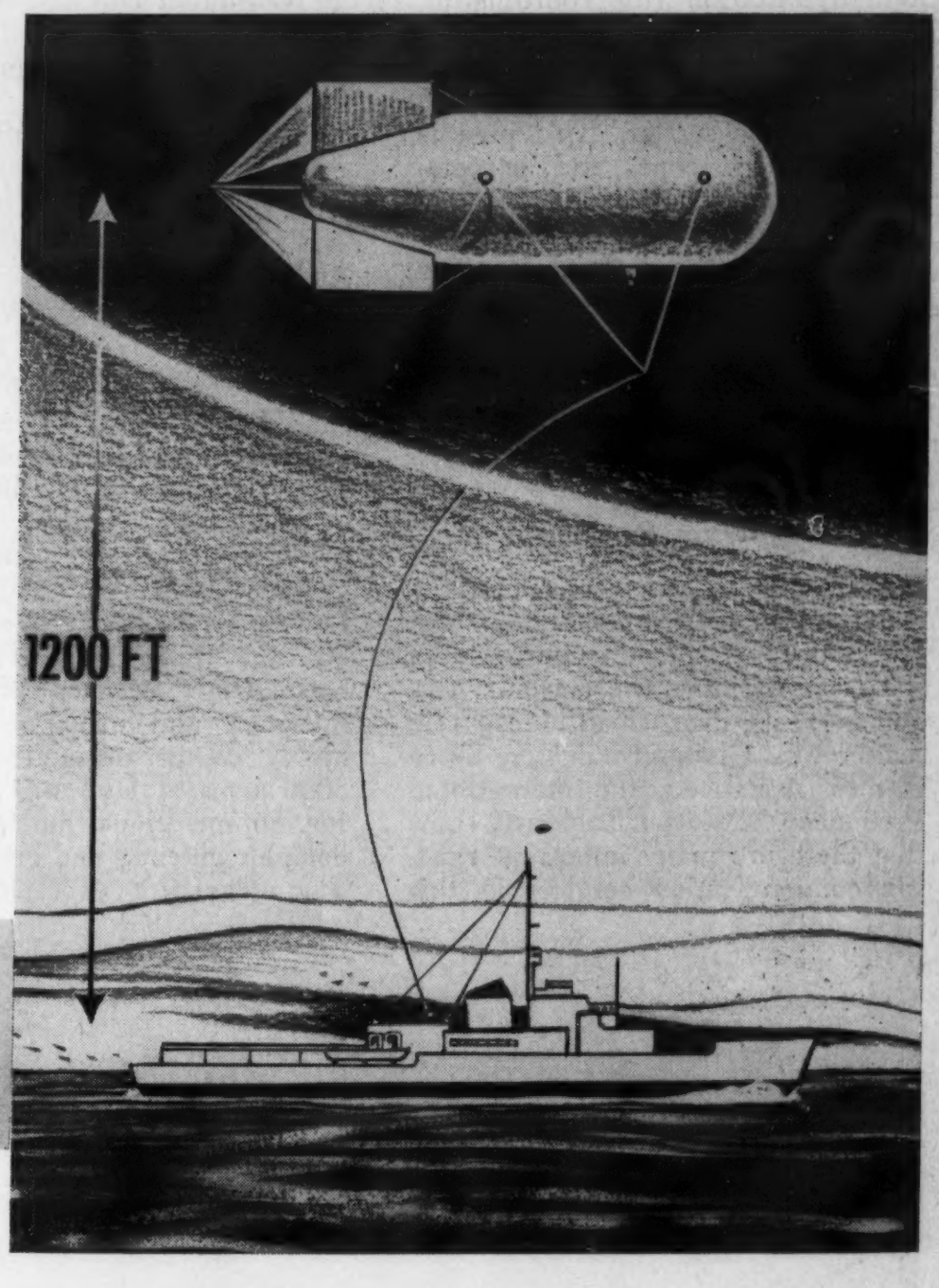
# Recent Developments in Naval Communications-Electronics

**An address presented to the South Carolina Chapter of the AFCEA**

by Rear Admiral
H. C. BRUTON, USN
DIRECTOR OF NAVAL COMMUNICATIONS




A 1200-foot balloon-supported antenna, developed by the Naval Research Laboratory, enables effective communications from polar latitudes using low frequencies, near 200 kilocycles.

I WOULD LIKE TO DISCUSS BRIEFLY some recent developments in communications-electronics by or within your Navy.

Stability and other considerations delayed the introduction of single sideband techniques into the Fleet after the single sideband had already proved itself in reliable day-to-day use in our point-to-point circuits. With improvements in equipment and techniques and the need to take the final step, the Chief of Naval Operations last year established the firm policy that all future procurement of M/HF equipment for ships and large naval aircraft must have a single sideband capability, or be readily adaptable to employ single sideband. Once the step was taken, all hands became enthusiastic about our single sideband conversion program, which is aimed particularly at today's needs for communications between widely dispersed ships and formations of the atomic-age Navy.

Our objective is, first, to establish a single sideband, single-channel, voice capability, and as soon thereafter as possible, to utilize this technique for multi-channel RATT (Radio Teletype) and data transmission.

We now have a limited quantity of commercial-type single sideband equipment in the Fleet for demonstration and special uses. We have an approved program for militarized single sideband equipment for many of our ships, but the equipment for this program is not expected to be ready for installation for about two years. Meanwhile, we expect to keep the single sideband technique alive in the Fleet, by meeting our most critical, immediate needs with the procurement of additional, though limited quantities, of the best commercial equipment available.

We in the military communications business, as with our friends in commercial communications, are constantly looking for new techniques or methods by which to give better service. An important recent advance of this nature is the application of forward scatter techniques to communications. This technique, undoubtedly familiar to most of you, uses radio propagation via VHF/UHF tropospheric scatter or VHF ionospheric scatter. By this means, it has been found that extremely reliable communications can be maintained

almost continuously, over distances of about 300 to 400 miles from the transmitter using tropospheric scatter, and from about 600 to 1400 miles from the transmitter using ionospheric scatter techniques. You can readily appreciate the military's interest. Because of this interest, the Joint Communications-Electronics Committee of the Joint Chiefs of Staff organization (the coordinating body for all military communications) has developed and recently approved a plan for the military use of ionospheric scatter. This plan is world-wide in scope, and is completely joint in that it designates in specific areas a single military service to provide the circuitry for use by all military departments. The Navy is charged with the responsibility for providing circuitry and facilities across the North Atlantic, and between the continental U. S. and Alaska.

### *Frequency Problems*

The radio frequency considerations in regard to scatter communications are a problem of some magnitude, since, for example, the optimum frequency range over which ionospheric scatter works is approximately 25 to 60 mcs. A glance at the International Frequency Allocation Table will show that there are many important existing communication services in this frequency band. Another factor complicating the frequency problem is the scatter receiver, which, of necessity, must be so constructed as to be highly sensitive to bring in the weak scatter signal. This makes the circuit relatively vulnerable to interference in the immediate area surrounding the receiver. Still another important factor is the high power required at the transmitter end of the circuit.

In spite of these and other difficulties, we feel that some provision for the use of scatter is a "must," because of its many advantages.

The possibilities of scatter are such, that some day we hope to employ it in the Fleet. The adaptation of scatter techniques to the requirement of non-directional transmission is a real problem.

### *Powerful Transmitter*

1956 marked the year when we really got underway with our new Very Low Frequency Radio Station in Washington County, Maine, the most northeasterly county in the United States. $4,000,000 was appropriated in Fiscal Year 1956 to buy the transmitter. The site has been firmly selected after a most thorough and extensive survey by highly competent engineers. About 3000 acres of land will be required for the operational buildings and the complex antenna and ground system. The antenna is expected to be the most efficient type that is possible to build within a reasonable dollar-limit.

The Maine transmitter itself may be rated as high as 2000 kilowatts (twice as powerful as the Jim Creek transmitter in the State of Washington), and we shall be disappointed if this new station is not the most powerful and effective station of its kind in the world. Certainly, it will be the world's most powerful Hi-Fi amplifier, as it will operate in the vicinity of 15,000 cycles, a little high for an old fellow like me to hear even with its high power. Budgetary and other matters permitting, we hope to have this station in operation by about mid-1960.

### *Future Planning*

Completion of this new station will provide the Navy with four high-powered VLF stations. To cover the Western Pacific, we also now operate under lease a medium-powered (250 K.W. alternator) Japanese VLF transmitter at Yosami, Japan. Our future planning provides for a fifth VLF station at Guam.

At the present time, we operate these expensive, powerful VLF stations on single channel, slow speed CW, because, even at their present limited capacity, the propagation characteristics of VLF frequencies provide advantages, particularly for

**Among the many problems facing naval communicators in the antarctic are extreme, high winds, unusual atmospheric conditions, auroral phenomena, abundance of snow, and temperatures of 80 degrees below zero.**

naval use, that are unattainable at other frequencies.

We hope that developments now underway will soon permit the operation of these stations at teletypewriter speeds, and eventually, on multi-channel RATT. When that occurs we will be getting a real return on our large investment in all of these stations.

### *Extension of Data Transmission*

The Navy is expanding the use of data processing and transmission ashore, based on our operating experience with electrical transmission by wire, of personnel data between Norfolk, Virginia, and Washington, D. C. Personnel accounting activities on both the East Coast and West Coast are already connected directly to the Washington headquarters by means of punched card transceiver equipment and leased landline facilities. We are planning the extension of this service, by radio links, to major overseas manpower data relay stations. Also planned for calendar years 1957 and 1958, is the extension of data transmission to personnel accounting machine installations at all Naval District headquarters, training centers, receiving centers, and air training commands in the continental United States.

Data transmission is also being used increasingly by the Navy in supply management and operations. The Naval Aviation Supply Office in Philadelphia is now connected with selected supply stocking activities in the continental United States, through punched card transceiver equipment and connecting leased lines. Connections to more supply stocking activities, both continental and overseas, are planned.

It is also through data transmission that control and coordination will be exercised over new weapons systems and tactical formations of the atomic-age Navy afloat.

New techniques are being developed for shipboard use to transmit rapidly from ship to ship, the vast quantities of data required for air offense and defense, missile control, and anti-submarine warfare.

### *Significant Developments in Weather Communications*

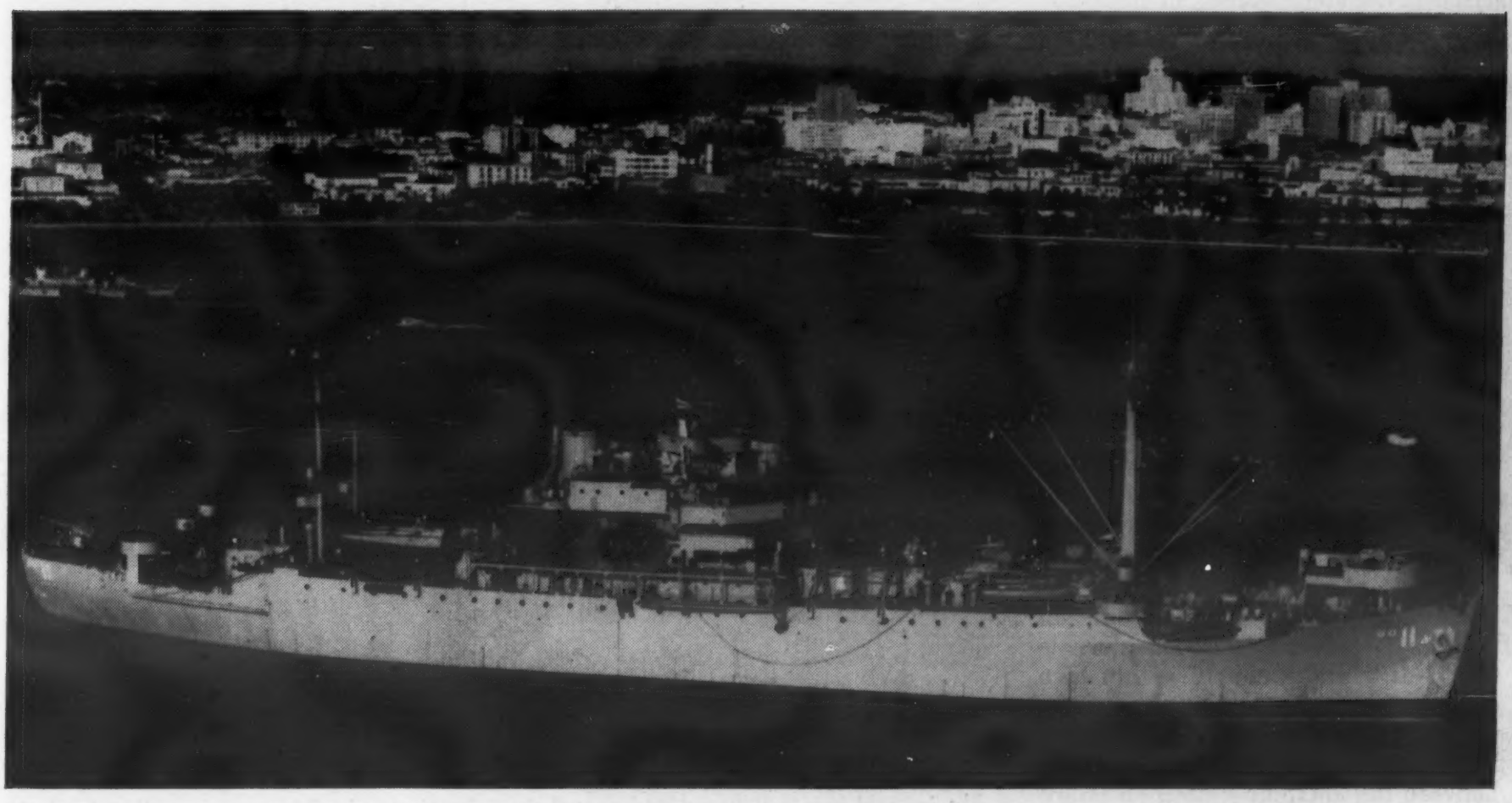
The year 1956 recorded several significant developments in weather communications which have improved mankind's defenses against the weather. Two of these developments are the Navy's Automatic Weather Radio Stations, and Transosonde, or "Trans-Ocean Sounding System."

The Navy's Automatic Weather Radio Station consists of a free-floating buoy about thirty feet long. Equipped with a radio transmitter, the buoy is automatically programmed to transmit meteorological information, consisting of atmospheric pressure, air temperature, seawater temperature, and wind speed and direction, in a pre-determined sequence, at intervals of six hours for a period of two months, over a range of 1,000 to 1,200 miles. Although the average power of the transmitter is only 15 watts, it utilizes pulse techniques, providing the equivalent of up to 250 watts of radiated power.

### *Balloons Offer An Answer*

These radio robots are already providing the nation with hurricane and other weather information in the tropical Atlantic, the Caribbean and the Gulf of Mexico, whether or not ships are in the vicinity. Thus the Navy is now employing automatic radio devices to spy on the hurricane enemy, day and night, in the national interest.

As for Transosonde, a quick look at a map of the Pacific Ocean shows hundreds of thousands of square miles without even an island or atoll. There is no place except the sea in which to establish weather outposts —or so it would seem. In the continental United States, there are 66 stations reporting upper atmospheric



USS ELDORADO in arctic waters "talked" with Navy amateurs at Little America, under the Navy's liberalized policy permitting licensed amateurs to man amateur radio stations in ships on isolated or unusual duty.

conditions. Yet in the Pacific Ocean, the place of origin of the weather for the United States, our sources of information are scant compared to what they should be, and to what they are going to be, for weather information is vitally important not only to our national defense, but also to the economy and well-being of the Nation as a whole.

To Navy meteorologists, balloons offered an answer. Early in 1956, twenty unusual weather communications balloons were launched from Japan, with remarkable results, and with them was launched a new system of weather coverage.

These forty-foot plastic balloons, of a thinness of a cellophane cigarette wrapper, carry instrumented gondolas over distances of thousands of miles, gathering and transmitting vital weather information.

### *Navy's Amateur Radio Operations*

The Navy proposes to inaugurate the Transosonde system on a regular basis. This would provide radio-transmitted weather reports from about 108 mobile Pacific locations, which would compare favorably with the 66 stations now located in the continental United States.

Of particular interest to radio amateurs are the Navy's Amateur Radio Operations. In our Naval Reserve program, the Naval Reserve Training Centers and Electronics Facilities (consisting of 530 activities throughout the United States) are all active in amateur radio, in addition to their regular military training program activities.

### *Radio Staitons at Antarctica*

Until very recently, amateur operation in Navy ships was prohibited. The Navy in 1956 liberalized this policy to permit radio amateur stations in some ships that are on isolated or unusual duty, provided the Commanding Officer desires the station, that it can be manned by Navy personnel who are licensed amateurs, and that the station and its operation meet all FCC requirements. One of the first ships so authorized was the *USS Eldorado*, a communications-command ship engaged in Arctic Dew Line re-supply operations. During this operation Navy amateurs on board not only handled considerable traffic of a morale nature, but also established communications from points nearly Pole to Pole. A twenty minutes solid contact was established between the amateur station on board the *Eldorado* in arctic waters, and the Navy-sponsored amateur station at Little America in the antarctic.

We now have two Navy-sponsored amateur radio stations at Antarctica and others are expected to be established.

### *Amateurs Fill Vacuum*

The Navy has always recognized the importance of the amateur radio operator. He has proved his value during floods and other disasters, and in national emergencies when the skills of radio amateurs were a definite national defense asset. In 1917 when the United States declared war, there were approximately 6000 radio amateurs, and more than 4000 of them rendered valuable service in the military forces. During World War II, the radio amateurs again filled the vast vacuum in our military requirements for trained operators and technical personnel.

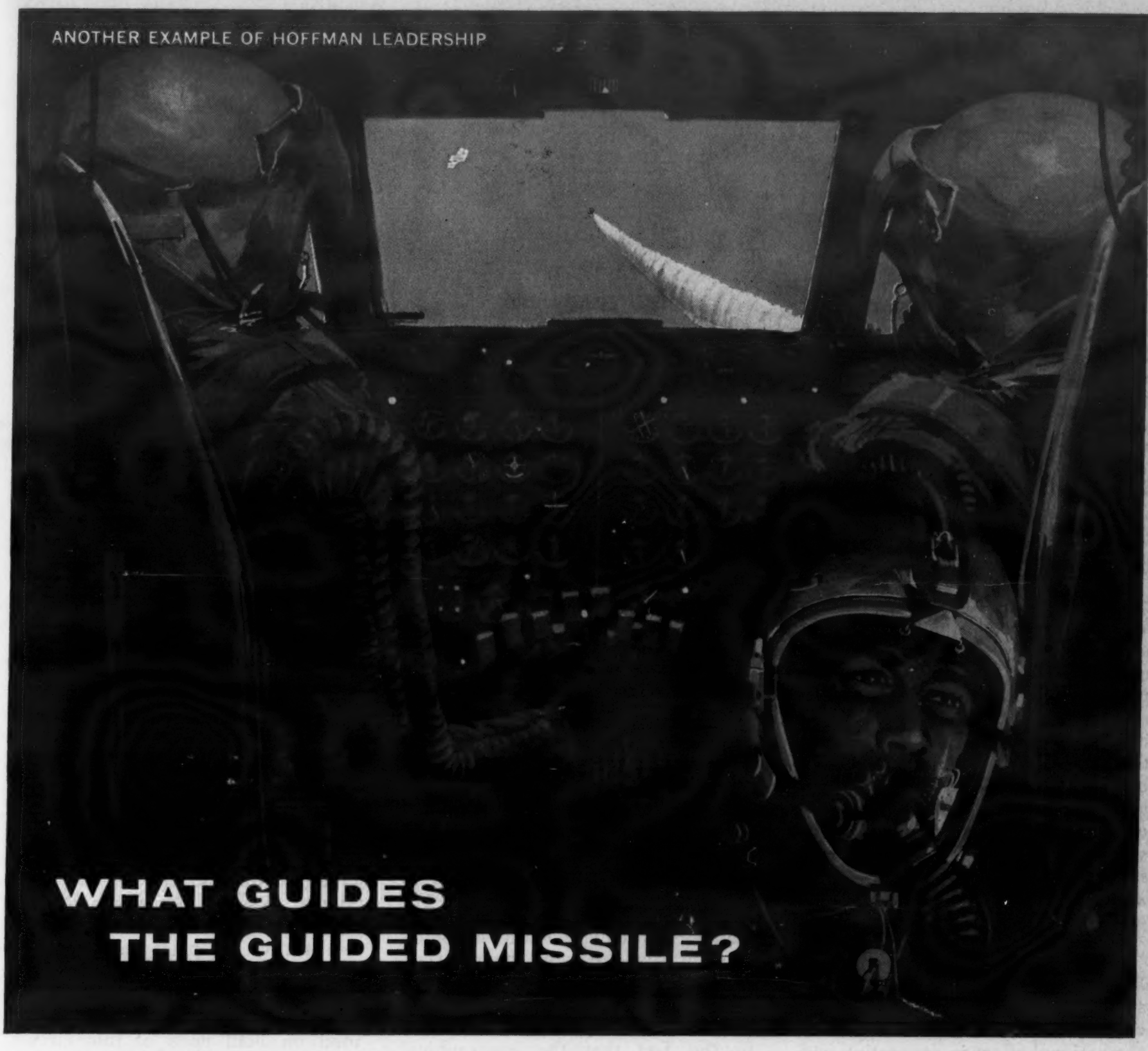
In the United States there are now in excess of 125,000 radio amateurs. Many of these are professionals engaged commercially or militarily in the electronics field. They enjoy radio as a hobby, yet often apply professionally the knowledge gained from their amateur activities. The Navy encourages its personnel to participate in amateur radio. Many Navy shore activities have been authorized to operate amateur radio stations, and surplus equipment often has been provided for this purpose. We in the Navy recognize that the opportunity to construct equipment, experiment, and improve operating ability enhances the value to the Navy of participating personnel.

### *Propagation Problems*

Our Naval Research Laboratories were largely responsible for many significant developments in communications-electronics during 1956. To mention a few, Navy scientists developed the SKYHOOK, advanced the Earth Satellite program, and made radio contact with the planet Mars.

Propagation problems found in the earth's polar regions were the motivation for the development of improved antennas for reliable transmission on frequencies at or near 200 kilocycles. As one answer, the Naval Research Laboratory developed the SKYHOOK, a helium-filled, zeppelin-type balloon supporting a 1,200 foot

The ice-cold planet Mars emitted enough heat for Navy scientists to pick up the signals 35 million miles away with a dish antenna 50 feet in diameter.



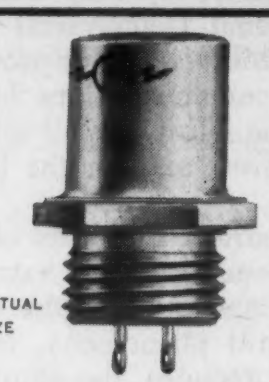

Air-to-air missiles must be guided from the mother plane during that brief interval between the closing of the firing switch and the instant the missile locks on its target. This is the critical moment when a success or failure depends upon the exactness with which computers in the mother plane direct the missile's flight. This is the moment when nothing is as vital to the kill as the precision voltage reference system controlling the computers.

For jobs like these, electronic manufacturers have learned to depend upon Hoffman Semiconductor Zener Reference Diodes. Engineered for use in all types of precision power supplies, these amazingly rugged silicon junction components typify the continuing leadership of Hoffman in the semiconductor field.

Hoffman subminiature Zener Diodes deliver predictable outputs to ±.1 per cent over a temperature range from −65°C to +150°C—withstand ± 15G vibration, 100G shock and 50G acceleration loads under the severest humidity and altitude environments.

Whether for analog and digital computers, missile control, telemetering, limiting, clipping, voltage regulation or power supplies where size, weight and stability are critical requirements—Hoffman Semiconductor Zener Diodes are the indispensable voltage reference source.

Hoffman engineers will be glad to supply additional information on request.

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antenna, which would enable a ship or fixed station to communicate effectively from the polar latitudes using low frequencies. A balloon-supported antenna has also been used by at least one shipboard VOA transmitter.

### *Radio Contact With Mars*

During 1956, the Naval Research Laboratory also completed its earth satellite model under Project Vanguard, and advanced preparations to carry communications toward space during 1957. The instrumented satellite will contain unique communications equipment. Project Vanguard may be expected to awaken more interest in space communications and sustain it longer among the peoples of the earth, than virtually any recent, single event.

Projecting communications beyond the satellite, radio contact with the planet Mars was accomplished by the Navy in the Fall of 1956. Even though Mars is a cold planet, its heat alone is responsible for the radiation of electromagnetic energy which made possible the reception of the planet's radio waves on earth. Mars' surface heat is estimated at about 32 degrees Fahrenheit. Even so, the ice-cold planet emitted enough heat, and the Navy's dish antenna and receiving equipment were sufficiently sensitive to pick up the signals 35,000,000 miles through space. Mars' wavelengths measured about 3 centimeters.

### *Hazards of Antarctica*

The Navy has been assigned responsibility for providing communications at Antarctica, in support of the national effort in connection with the International Geophysical Year. This responsibility includes provision of adequate communications for the U. S. scientific effort, for all military services involved, and for the United States press.

Communications problems of Antarctica are complicated by extremely high winds, unusual atmospheric conditions, auroral phenomena, lack of conventional grounds, the abundance of snow, and, of course, the human element. Temperatures drop to more than –80 degrees Fahrenheit. Winds often exceed 100 miles per hour. Geomagnetic storms occur frequently.

Atmospheric pressure, air temperature, sea water temperature, wind speed and direction, are transmitted automatically by the Navy's new free-floating weather buoy.

Atmospheric moisture is virtually not present.

In the antarctic, it is possible to lay bare antenna wire directly on the ice, and because of the good insulation property of ice, to obtain excellent communications results. But because this procedure is hazardous, antennas must be elevated on solid piling. In holes for the antennae poles, a mixture of snow and water instead of concrete or cement is poured, with equally effective results. In short, they are using the materials at hand.

One of our unusual propagation problems at the South Pole is due to the fact that the geographical South Pole is situated in a saucer at about 9500 feet elevation, whereas the surrounding territory rises to a polar plateau.

Our Navy McMurdo Sound station is located directly adjacent to Mt. Erebus, an active volcano. Not only must we contend with the volcanics of the mountain, but also with its mineral content, for this mineralized volcano stands between our rhombic antennas at McMurdo Sound and Radio Balboa, Canal Zone.

Nations participating with the United States in the antarctic during the IGY are cooperating to keep radio interference among the several international stations at a minimum. In this common effort, the United States has been allocated four stations, and other nations a total of seventeen. The nations represented in this international cooperative communications effort, in addition to the United States, are Argentina, Australia, Belgium, Chile, France, Japan, New Zealand, Norway, the Union of South Africa, the United Kingdom and the USSR.

### *An Alternate Route*

In this undertaking, United States naval radio frequencies have been authorized for use by and for communications among the U. S. stations in the antarctic, for the duration of the International Geophysical Year. Communications with the United States are being conducted by continuous wave (CW) radio-teletypewriter, facsimile, and, of course, voice. Generally, intercommunications among United States stations in the antarctic will be conducted by military operators using naval procedure.

The main communication channel between Antarctica and the U. S. is a duplex radio-teletypewriter circuit between McMurdo Sound and Balboa, C. Z., and thence via the Naval Communication System. This circuit is presently in operation approximately 5 hours daily, being limited by propagation conditions. During this operational period, McMurdo Sound transmits all the operational, administrative and press traffic that has accumulated since the preceding day, which at times exceeds 40,000 groups.

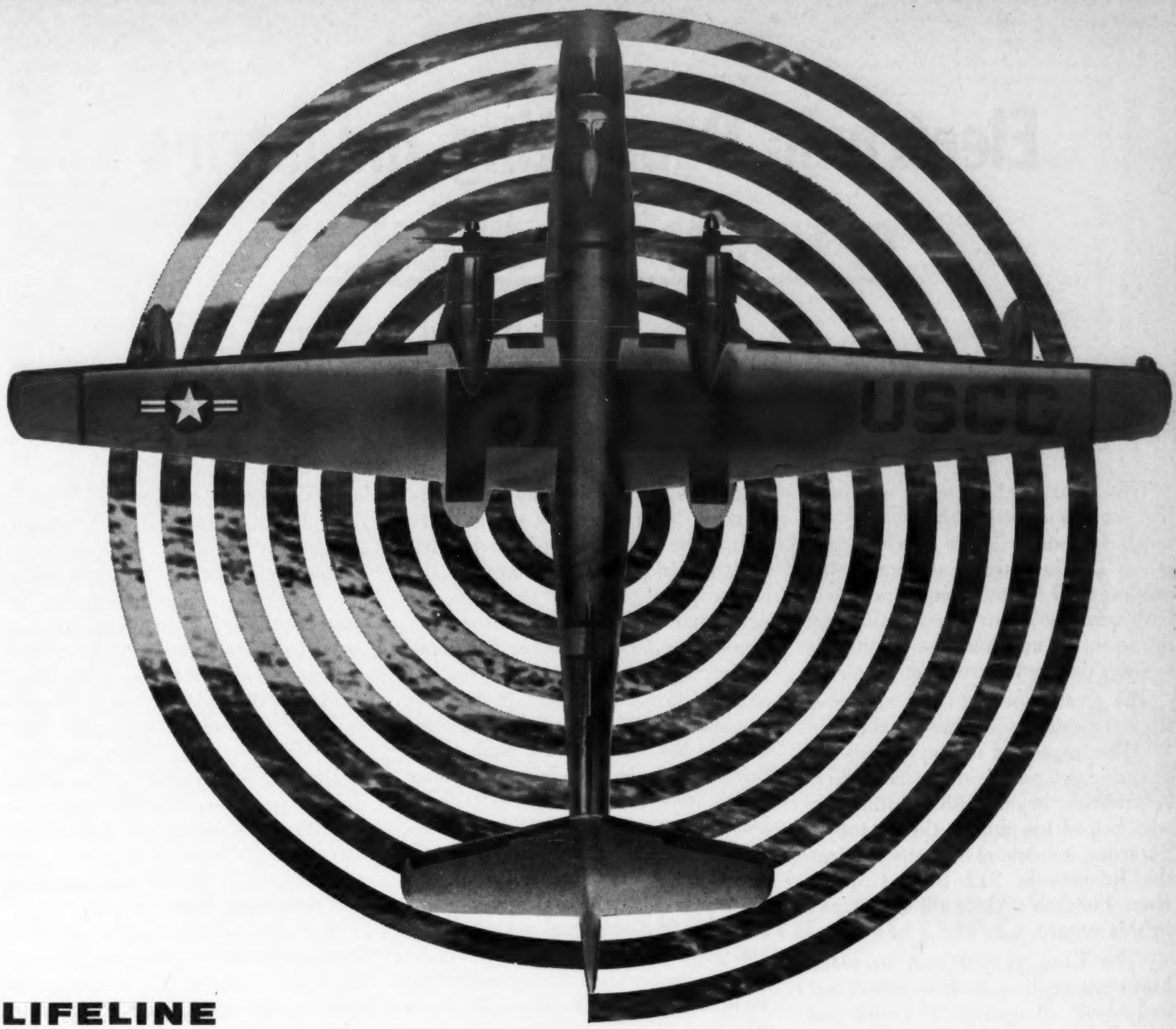
Directional rhombic antennas are used on both ends of this circuit. A 1-KW transmitter is employed at McMurdo (the best frequency is 17 mcs this time of the year). The transmitter employed by Balboa, where major naval communication facilities are available, may have as much as 20 KW power output.

There are usually from six to ten correspondents who file press messages with McMurdo. All are good writers, and the press load seems to indicate that some are quite prolific.

An alternate route from Antarctica to the United States has been planned, via New Zealand and the Pacific Island Chain, and is now being activated. This route will provide a supplemental RATT capability. We are bending every effort to provide adequate communications service for the important scientific effort of the International Geophysical Year.

---

***Rear Admiral Henry C. Bruton, USN, a Naval Academy graduate, received a Master of Science degree from the University of California, a Juris Doctor degree from George Washington University and is now serving as Director, Naval Communications. Admiral Bruton is also First Vice President and National Director of AFCEA. Recently he was made an honorary member of the Veteran Wireless Operators Association.***




## LIFELINE

••• --- ••• These are the "call letters" of the U. S. Coast Guard. Watching over more than half a million square miles of our coastal waters, the rescue record of this famous organization is one of the great air-sea sagas of war and peacetime service. Helping to extend the Coast Guard's far-flung lifeline is the Martin P5M and the new P5M-2G, providing long-range sea reconnaissance for any emergency. Also, in active service with both the Atlantic and Pacific fleets of the U. S. Navy, ten squadrons of this famous seaplane—specially armored for anti-submarine warfare—are in operation today, from Norfolk to the Mediterranean and from Washington to the Orient.

**MARTIN**

BALTIMORE·DENVER·ORLANDO

# Electronic Computing Industries

## OPTIMISM VS. JUDGMENT

by Howard Engstrom
NATIONAL SECURITY AGENCY

THE TERM "ELECTRONIC computing" covers a wide range of equipment. It is used in this article in the sense of the large-scale internally programmed digital computers which have made so many contributions to the scientific and business life of the country during the past five years.

The great impetus to this art came from the military during World War II. The impact of military needs on scientific progress is not a new thing. It probably began with Archimedes, who helped his cousin, the tyrant of Syracuse, to defend the city against the Romans in 212 B.C. I quote from Plutarch's "Life of Marcellus" in this regard.

"The King prayed him to make him some engines, both to assault and defend, in all manner of sieges and assaults. So Archimedes made him many engines, but King Hieron never occupied any of them, because he reigned the most part of his time in peace without any wars."

### *Practical Electronic Devices*

The electronic computing engines were constructed during World War II and some of them made significant contributions to our victory. However, it was not really until the end of World War II that the general purpose electronic computing devices began to be delivered. The conviction of their practicality and the faith in the future rested principally among those people who had been working in the field for the military during the war. The Defense Department in general was convinced of the necessity of pursuing research and development in this area in the solution of military problems. American industry in 1946 was, however, not so convinced. As a result, in the post-war period, many individuals, with faith in the future of the field, established small independent companies which were financed by the Defense Department. Some of the universities, such as Harvard, Princeton, and the University of Pennsylvania, also carried on research and development in the logical structure and component development in the field. Again in these universities the program was stimulated essentially by individuals who had faith in the future of large-scale computing devices. University management was not convinced, and in some cases still remain unconvinced, that the field of logical structure design of computing devices was one with proper academic stature.

### *It's Big Business*

About 1950 many of the problems, with respect to memories, input-output devices and peripheral equipment, had been solved so that well balanced large-scale computing devices were put into operation. At this point, big business became strongly interested in the field. Many of the small companies, who had had a difficult financial struggle to keep going, were merged with the large companies so that in the early 1950's the electronic data processing industry achieved a financial stability as well as a technical maturity. It is difficult to estimate the phenomenal growth of the industry. It is certainly true that the present volume of business in electronic data handling equipment is in excess of one billion dollars per year. Speculations as to its ultimate position are difficult but certainly, the industry will not reach a saturation point before expanding by, at least, a factor of ten.

The delivery of many of these equipments to industry and Government has opened up a tremendous activity in the field of applications. The most important aspect of electronic computation in the last several years has been precisely in the area of a better understanding of the value of this equipment in our scientific and business problems.

### *Problem Areas*

Although the industry has achieved technical reliability and financial stability, there are many areas in which serious problems still exist.

The enthusiasm with which electronic data handling and automation possibilities have been greeted is astonishing. I should not like to state categorically that the field has

*(Continued on page 28)*


EARLY TELETYPEWRITER


TELETYPE MODEL 28 PRINTER

# 50 YEARS THAT CHANGED THE PICTURE

The need for a reliable printing telegraph instrument that would provide a typed record of the message for both sender and receiver brought the company now known as the Teletype Corporation into the picture in 1907. From the halting performance of the original page printer to the smooth 100 words per minute of today's precision equipment has been a major step in communications.

But today Teletype equipment is often far more than a communication instrument. It is a basic element in production control systems . . . its ability to transmit and reproduce text and punched tape is harnessed to office automation . . . it provides a "conveyor system" for channeling complex raw data to a computing center thousands of miles away—and getting the answers back in a twinkling.

Indeed, Teletype machines have made many of the dreams of 1907 a daily part of today's business world. And the horizons widen daily as new dreams occupy our engineers and keep our laboratories humming.

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*1957 Golden Anniversary Year*

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TELETYPE CORPORATION

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INCORPORATED

Guests at the National Bureau of Standards' Open House were among the first to see the Bureau's electronic digital computer, SEAC, located on the NBS grounds. In the background is the computer proper, consisting of arithmetic and control units and power supply. At left is a magnetic tape auxiliary memory. At right are the control console and input-output equipment.

# a progress report on SEAC


by Margaret R. Fox

DATA PROCESSING SYSTEMS DIVISION
NATIONAL BUREAU OF STANDARDS


OVER SIX AND A HALF YEARS AGO, in May 1950, the National Bureau of Standards announced completion and successful operation of SEAC, Standards Electronic Automatic Computer, by the staff of its Electronic Computer Laboratory. The computer, designed and constructed in less than two years, was achieved under the sponsorship of the Office of Air Comptroller, Department of the Air Force, which was pioneering in the application of the relatively new digital technology to its large-scale problems of logistics and management. [Fig. B, Page 20]

On June 20, 1956, SEAC celebrated the sixth anniversary of its dedication and the completion of over six years of productive operation, most of which has been on a round-the-clock schedule. The following schedule for that day indicates the utility and versatility of this system which was to have been only an "interim installation:" [Fig. A, Page 20]

Although SEAC was basically designed as a high-speed computer for scientific problems, which inherently have small or moderate input-output requirements, the original system has been augmented sufficiently to undertake data-processing problems of the type that require a great deal of data manipulation and a relatively small amount of actual computation.

The versatility of use as indicated by the many types of problems that have been solved by SEAC is in keeping with the original design of the system as a nucleus to be expanded to meet problem-solving requirements and to test technological advances in the computer field. *It has indeed been a proving ground for new engineering techniques and the tool on which to try out model problems in massive data processing.*

### *Army-Sponsored Program*

The story of SEAC is essentially the history of the development of digital electronic computing machines by and for the Government following the successful application of the ENIAC, Electronic Numerical Integrator and Calculator, to Army Ordnance ballistics problems. On February 1, 1946, an Electronics Section was established within the Ordnance Development Division of the National Bureau of Standards as a joint endeavor of the Office of the Army Chief of Ordnance and the Bureau. The Army-sponsored program for the development of basic elements and organs for electronic digital computing machines was assigned to this section primarily because it involved a combination of electronic instrumentation and electron tube problems on which work was already in progress in connection with the proximity fuze program. In addition, there existed a certain amount of technical appreciation of the fundamental ordnance computing problems to be handled by such machines and, hence, a general knowledge and understanding of the requirements of the basic elements for such machines.

The Army Ordnance work program encompassed research and development on electronic methods and means for carrying out, at high speeds, complex scientific computations, initial efforts were directed to the development of memory devices, input-output equipment, and conversion equipment for transducing data onto input media and converting data from output media into usable form, as well as, investigation of the basic elements for use in the computing function. Rapid advances in the digital computer art soon resulted

*(Continued on page 20)*

# SIGNAL MAGAZINE

## WELCOMES

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## WASHINGTON, D. C.

# INTERNATIONAL PHOTOGRAPHIC EXPOSITION, 57

**MARCH 22-31**

***national guard armory***

SIGNAL magazine welcomes the International Photographic Exposition of 1957, to Washington, D. C.

From March 22 to 31, more than 200 photographic firms throughout the free world will display their newest products and techniques that will far surpass in size, scope and content any international trade fair ever held in the United States.

More than half a mile of prize-winning photographs from many international contests will be exhibited in a huge gallery. Photography's contribution to man's progress will be reviewed in a 400-foot long epic, which will include aspects of industry, photo-journalism, education, medicine, and such sciences as radiology, nuclear research and social science.

In the evenings from March 25 to 29 inclusive, the Exposition will be a dramatized report to the trade on progress, research, equipment, techniques and products.

General Electric's 25,000 candle power flash of "photo lightning," the world's largest photo lamp, will illuminate the sky atop the armory every night and the entire International Exposition will be transformed into a spectacular show for the public: a "World's Fair of Photography."

| *Schedule* | | *Trade Show Hours* | *Hours For The Public* |
|---|---|---|---|
| *Fri.,* | *March 22* | | *7:45 pm to 10:30 pm* |
| *Sat.,* | *March 23* | | *2:00 pm to 10:30 pm* |
| *Sun.,* | *March 24* | | *2:00 pm to 9:30 pm* |
| *Mon.,* | *March 25* | *12:00 noon to 7:30 pm* | *7:30 pm to 10:30 pm* |
| *Tues.,* | *March 26* | *12:00 noon to 7:30 pm* | *7:30 pm to 10:30 pm* |
| *Wed.,* | *March 27* | *12:00 noon to 7:30 pm* | *7:30 pm to 10:30 pm* |
| *Thurs.,* | *March 28* | *12:00 noon to 7:30 pm* | *7:30 pm to 10:30 pm* |
| *Fri.,* | *March 29* | *12:00 noon to 7:30 pm* | *7:30 pm to 10:30 pm* |
| *Sat.,* | *March 30* | | *2:00 pm to 10:30 pm* |
| *Sun.,* | *March 31* | | *2:00 pm to 9:30 pm* |

## A WORLD'S FAIR OF PHOTOGRAPHY

**Operating Log for June 20, 1956**

| *Time* | *Description of Problem with Comments* |
|---|---|
| 0000-0730 | 1. Radiation diffusion—6 hrs, 30 minutes plus 1 hour down time. |
| 0730-1305 | Scheduled Maintenance and Engineering—5 hrs. 35 minutes. |
| 1305-1323 | 2. Transistor amplifier—18 minutes. |
| 1323-1340 | 3. Integral for scattering functions—17 minutes. |
| 1340-1400 | 4. Electron penetration—20 minutes. |
| 1400-1420 | 5. Collision integrals used in transport theory—20 minutes. |
| 1420-1440 | 6. Research in mathematical geophysics—20 minutes. |
| 1440-1500 | 7. Standard deviation—20 minutes. |
| 1500-1510 | Training period—10 minutes. |
| 1510-1520 | 8. Tables of Coulomb wave functions—10 minutes. |
| 1520-1540 | 9. Nuclear scattering—20 minutes. |
| 1540-1600 | 10. Continuation of Problem 1—20 minutes. |
| 1600-1622 | 11. Vibrations of a circular disc—22 minutes. |
| 1622-1635 | 12. Continued fraction—13 minutes. |
| 1635-1640 | 13. Continuation of Problem 2—5 minutes. |
| 1640-1705 | 14. Ray tracing, II—25 minutes. |
| 1705-1720 | 15. Continuation of Problem 2—15 minutes. |
| 1720-2400 | 16. L-Shell conversion coefficients—5 hrs., 30 minutes plus 1 hr., 10 minutes down time. |

| | | |
|---|---|---|
| Good computation | 16 hrs. | 15 minutes |
| Down Time | 2 | 10 |
| Scheduled maintenance and engineering | 5 | 35 |
| | 24 hrs. | 00 |

Figure A

May 9, 1950
First Skew Ray traced by NBS Automatic computer (SEAC)

Ruth Haueter
Frans Alt
Don Feder
Ted Marden

00000000000 200000000000

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09984064483 00564319407-
00000000000 00042223986
00499999999 00000000000
00000000001 00000000001
09813864904 01920431108-
00000000000 00049023214-
00476331249 00000000000
00000000002 00000000001
09950887234 00426816441-
00000000000 00047212476-
00475585543 00000000000
00000000003 00000000001
09973677567 00697034484-
00000000000 00000552661-
00470174563 00000000000
00000000004 00000000001
09975543100 00698956257-
00000000000 00009313899
00264965718 00000000000
00000000005 00000000001
09913641747 01311376108-
00000000000 00003907538-
00244872008 00000000000
00000000006 00000000001
09980731349 00620485075-
00000000000 00008429233-
00224305344 00000000000
00000000007 00000000001
09990214692 00442278634-
00000000000 00010428009
00213186094 00000000000
00000000008 00000000001
09990214692 00442278634-
00000000000 00000000000
00000114772- 00000000000
00000000009 00000000001

Figure B

This is an actual reproduction of the teletype printed results of the first problem successfully solved by SEAC and autographed by the attendant electronic scientist and mathematicians.

in an expansion and reorientation of the original program to include the design of rudimentary calculating systems.

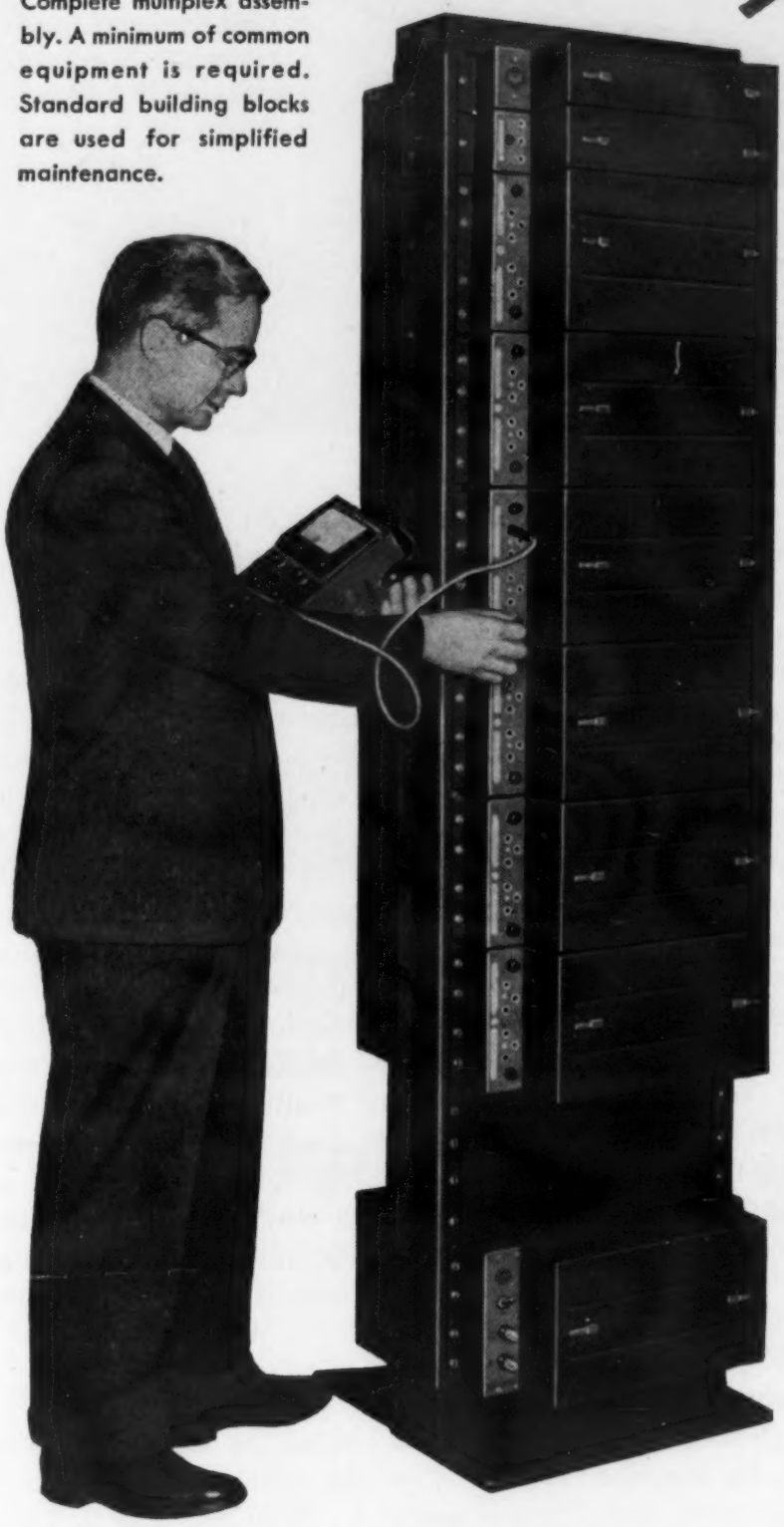
### *Census Computer Sought*

Meanwhile, NBS was entering the computer field through another channel. In 1945, the Bureau of the Census, with its immense task of sorting, tabulating and editing census data, became convinced that it would be practicable to apply an automatic electronic digital computing machine, similar to ENIAC but more flexible, to its large-scale statistical and tabulation problems. It requested the Science Committee of the Department of Commerce to evaluate the potential application of such computers to the compilation of census data and the wider exploitation of modern statistical methods in the preparation of census reports. The National Bureau of Standards was called in to advise the Committee and the Bureau of the Census concerning the feasibility of construction of an automatic electronic computer suitable for the needs of the Bureau of the Census in light of the state of development of the art. As a result, the National Bureau of Standards was made responsible for the selection of a supplier and for the technical supervision of the construction of a census computer. At that time it did not appear unreasonable to expect such a system to be in operation by late 1948.

About the same time, the National Bureau of Standards undertook a study of Government-wide needs for such machinery, and there was established the Applied Mathematics Executive Council, on which were represented all interested Government agencies. Many of these agencies, including the Army Map Service, Office of Air Comptroller, Office of Naval Research, and Air Materiel Command, took the lead of the Bureau of the Census and asked the National Bureau of Standards to negotiate with suppliers for computers for their applications. Meantime, a series of delays occurred, partly due to technological troubles encountered by the contractors in the design and construction of these "first-of-a-kind" devices and partly due to time consumed by such factors as security investigations, resolution of patent problems, and con-

(*Continued on page* 22)

# NOW... Big News in Microwave Multiplex Channeling Equipment!

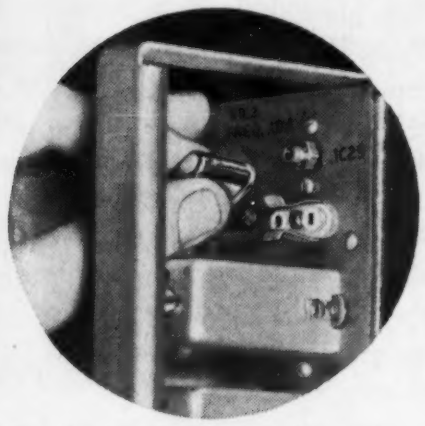


Complete multiplex assembly. A minimum of common equipment is required. Standard building blocks are used for simplified maintenance.

## New RCA Type MV-124 with All Channel Units Identical and Interchangeable

Specifically designed for microwave use and thoroughly field tested, this new RCA Channeling Equipment provides complete flexibility. Frequency selection is by means of a plug-in crystal. Except for this crystal, *all Channel Units are identical and interchangeable*, thus simplifying planning, installation and maintenance.

Whatever your channeling requirements, these famous quality Channel Units can be easily stacked to provide two channels, three channels, or up to 24 voice channels without group modulating. High capacity systems can be obtained by stacking 24 channel groups. One unit is required for each voice channel desired. Single sideband suppressed carrier techniques are used to supply 24 channels in the band between 10 kc and 130 kc frequency, leaving frequency space for 18 tone channels below 10 kc. Simultaneous transmission of many channels of intelligence is accomplished by modulating separate sub-carriers spaced uniformly throughout the base-band modulating system. Channels are spaced one above the other in the available modulating band width.



To change channel assignment, simply change one plug-in crystal.

**CRYSTAL CONTROL** assures high stability and greater accuracy. For operations such as frequency shift telegraph and facsimile transmissions, an unusually high degree of clarity is attained.

**DOUBLE HETERODYNING** enables all circuits in all units to be identical except for the plug-in crystal element.

**SINGLE SIDEBAND OPERATION** enables each channel to use a minimum of spectrum space. This means less obsolescence due to possible congestion of the available microwave spectrum.

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- ☐ RCA Multiplex Channeling Equipment
- ☐ RCA Microwave for use in.....

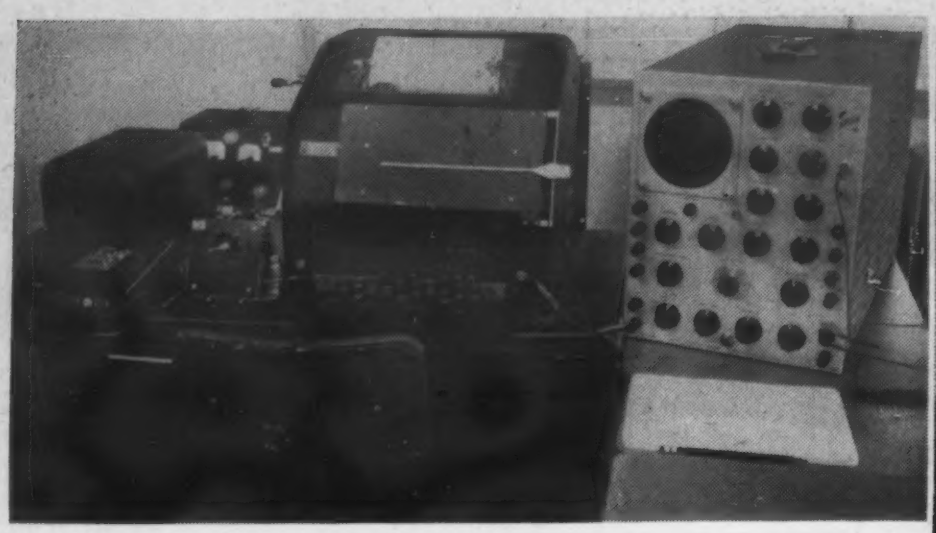
Name.....Title.....

Company.....

Address.....

City.....Zone.....State.....

☐ Have representative contact me.



A control console and external selector together with input and output magnetic wire drives were added to the initial equipment.

Both single-channel and multi-channel tape drive mechanisms have been added as an auxiliary memory.

tract negotiations. Costs also were rising rapidly, and the combination of increased prices and delayed delivery resulted in the decision for the National Bureau of Standards to undertake the construction of an "interim" machine.

In the summer of 1948, the urgent need of the Office of Air Comptroller for a computer, on which mathematical investigations of techniques for solving large logistics programming problems could be performed, led to a crash program of development and construction at NBS. By this time, the Bureau was engrossed in an extensive and expanding consulting and advisory service, a joint activity of the Applied Mathematics and Electronics Divisions which was based on a broad program of research, development, construction, procurement, and eventually testing and evaluating high-speed automatic digital electronic computers.

In order to expedite the physical realization of a minimum computing installation to serve the OAC's needs until more complete systems were commercially available, it was decided to utilize the EDVAC, Electronic Discrete Variable Automatic Computer, design insofar as practicable. The staff charged with the design and construction of the new computer had been closely associated with the evolution of the EDVAC, and engaged in the design and construction of the input-output and auxiliary equipment to complete the installation at Aberdeen Proving Ground. The basic concept was to provide a flexible minimum machine capable of handling certain important classes of mathematical problems that are readily solvable by the digital type of machine.

As it became increasingly apparent that no other equipment would become available for several years, the machine was planned and constructed as a nucleus to which improvements and sub-assemblies could be added to increase its problem-solving capabilities in accordance with future requirements. In addition, it was destined to be used as an engineering proving ground for evaluating new computer components and techniques.

### *Design and Function*

Design of the SEAC was begun in June 1948, and construction got under way early in 1949. Its function was like the other large-scale automatic machines then in development, having sections which carry out the four basic functions of input-output, memory, arithmetic and control. Purposely, the design was kept simple, and the list of basic operations was kept as short as possible. The internal memory, based on a design of the Moore School of Engineering and built under contract to specifications developed at NBS, consisted of mercury relay lines with associated recirculation amplifiers and mixing, distributing and selection circuits, capable of storing 512 45-binary-digit words, or eight words to a line.

The original installation consisted of the computer proper, operating at a basic repetition rate of one megacycle; the acoustic memory, a manual keyboard for direct input; and a teletype printer for direct output. Punched paper tape was used to provide indirect operation. Both numbers and instructions were represented by hexadecimal notation (base 16). Seven basic orders—addition, subtraction, multiplication, division, comparison, logical transfer, and input-output control—were chosen as a result of a study which indicated they were the minimum convenient for solving most of the problems then anticipated.

### *Expansion and Improvement*

Almost before the first real problem, skew ray calculations in optics, was solved by SEAC on May 9, 1950, work was under way to expand the installation, and several units have been incorporated in the system. The first major improvement was the addition of a high-speed electrostatic memory which holds 512 words stored on 45 Williams tubes, effectively doubling the memory size. All 45 tubes simultaneously supply the computer with 45 binary digits in parallel with average access time of

(*Continued on page* 24)

# MILITARY FIELD SERVICE

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The Todd Company, Inc., Rochester, N. Y.
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Looking to continuing expansion, Burroughs invites inquiries from qualified engineers.

12 microseconds. Although SEAC is a serial machine in all other respects, provision was made in the original design for the use of both serial and parallel types of memory. Conversion of the word form from serial to parallel, and vice versa, is accomplished by means of a shift register with a special flexible control.

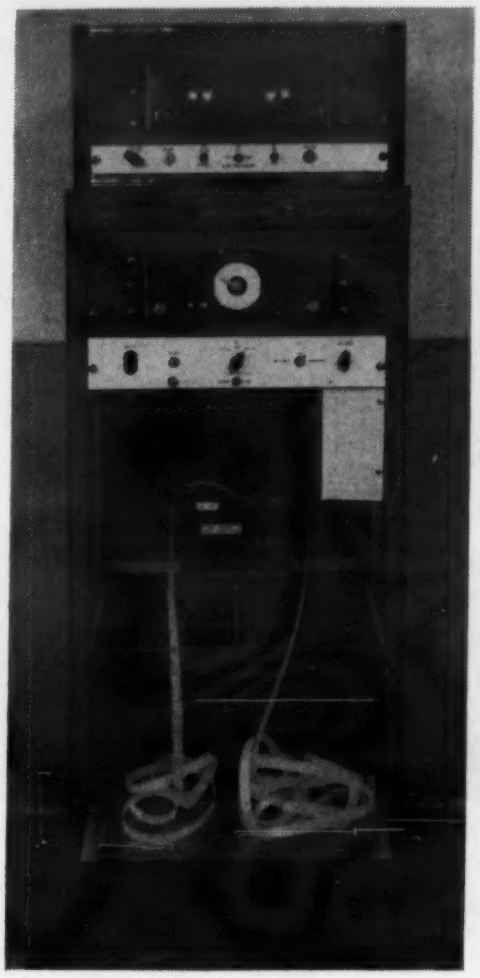
The original input-output devices were modified teletype equipment. The input was fed from either a tape reader or keyboard, and the output sent to either a printer or tape punch. Magnetic wire and magnetic tape units have been added to increase the speed of the computer on problems requiring considerable input-output or auxiliary memory capacity. An external selector capable of selecting under computer control any of ten different input-output units is also available. [Fig. 1]

Another major change permits the operator a choice between two modes of operation, the four-address and the added feature of three-address, by merely throwing a few switches on the control. The main distinction between four- and three-address modes of operation is in the method by which the instruction sequencing is indicated. In the three-address system, however, a special automatic "floating address" feature was included, aimed at shortening and simplifying the work of the programmer by permitting him to utilize standard routines or lists of instructions which have already been compiled for carrying out certain frequently used operations.

Early in 1956 the Williams memory was modified and improved to store 1,024 words, which, with the 512-word acoustic memory, has made a total of 1,536 words available for the past six months. Latest addition to the installation was the NBS Card Transcriber which went into regular operation in July. The equipment reads standard 80-column cards at a rate of 200 per minute and converts the data to a four- or six-bit binary code on magnetic wire for direct input or temporary storage as a magnetic recording. [Fig. 2]

Some measure of the expansion of the SEAC through engineering improvements can be made by comparing the original number of vacuum tubes and germanium diodes with the present number. In the original installation there were approximately 750 tubes and 10,500 diodes; in the present SEAC there are about 1,300 tubes and 16,000 diodes.

An unplanned event that interrupted the usual schedule occurred late in 1954. SEAC and the entire laboratory, of which it was a focal point, were transferred from their original site to a building about a block away. To move any computing installation is a major engineering accomplishment, but to move an essentially experimental laboratory model which, somewhat like Topsy, had just "growed," required careful preplanning and preparation. However, it did present an opportunity to generally improve its physical layout and connections. On November 21, 1954, SEAC was shut down and the entire installation moved to the newly prepared site. By the end of December, all the signal leads had been connected and the signals were being checked out.



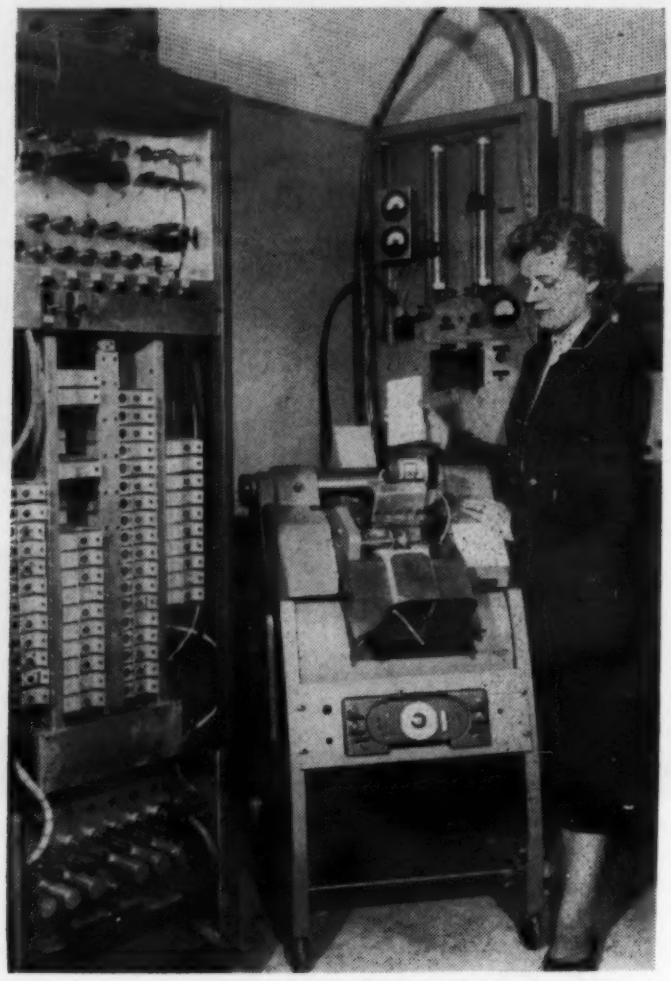


Fig. 1, left: Inscriber: punched paper tape to magnetic wire converter.

Fig. 2, right: Transcriber: punched card to magnetic wire converter.

### *High Efficiency Quota*

Debugging had progressed so well that the first engineering test routines were run on January 7, 1955, and on January 22, scheduled computation was resumed for evening and early morning shifts. Full three-shift operation was resumed on February 21, just three months from the day that it was deactivated. Demand for computing time continued to increase and scheduled round-the-clock operation was reinitiated late in February.

In the more than six years that SEAC has been in operation, its work loads in computation have been many and varied. In spite of a considerable amount of time being utilized by the engineering work associated with the expansion of SEAC and the trial of new techniques, approximately 19,200 hours of scheduled computation time have been logged through November 9, 1956, with an average efficiency of about 75%, the total good time over the total scheduled time. It may be of interest to note that efficiency so far in fiscal year, 1957, has averaged 84 per cent.

### *Contribution to the Air Force*

Fundamentally, SEAC's very being was a result of its anticipated service to the Office of Air Comptroller, U. S. Air Force, in the application of scientific methods to management. Their basic problem was to construct a "mathematical model" of Air Force operations consisting of sets of equations which spell out the re-

lationship of all Air Force activities to national military objectives and the requirements of every Air Force activity for personnel, supplies, equipment and facilities of all kinds. The computational load was so great, however, that it took months with conventional computing equipment to compute programs and requirements data. SEAC, which is capable of adding 4,000 13-decimal-digit numbers per second or performing 400 long divisions of such numbers per second, contributed immeasurably to reducing this time lag so that budget and program could be kept more reasonably consistent.

### *Assisting the Atomic Energy Commission*

A second major contribution to the science and security of our country was made by SEAC in performing important calculations necessary to the development of the H-bomb by the Atomic Energy Commission. A representative sampling of problems performed in its sixth year of operation includes the following: For the Department of Defense and the AEC, problems have been undertaken in radiation diffusion, award of procurement contracts by linear programming, integrals involved in supersonic flutter, heat convection, complete degradation in the neutron, reflex klystron efficiency, missile trajectory, dynamic behavior of aircraft structures, molecular vibration, and many others. The Bureau has operated SEAC as an NBS facility since January 1954 when the Air Force formally transferred its entire accountability to them. Problems in meteorology, thermodynamics, optics, air-conditioning, numerical analysis, crystal structure, thermal stresses, temperature and compressibility properties of air, and others too numerous to mention, have been solved for the technical divisions.

### *Promising Future*

One of the most interesting currently proposed uses is to have SEAC perform some of the tedious work of designing and developing scientific computers and data processors. Other studies are being undertaken to have SEAC do automatic coding. The future of SEAC, probably the oldest general-purpose automatic digital computer in the country, looks very promising in spite of its length of service and the expanding state of the art.

In the general data-processing field, SEAC has recently been used to demonstrate the feasibility of at least three unusual and interesting problems. A study was initiated for the Public Housing Agency in which SEAC was used to explore the feasibility of using automatic data processing equipment to check the reports of eligibility of occupants of the 400,000 units of low-rent housing under PHA jurisdiction. These reports, which contain a great volume of statistical data, are submitted annually, and must be checked for internal consistency and then audited for compliance with the rules and regulations governing occupancy. Erroneous and missing data results in correspondence to the field for correction before the reports are submitted to Statistical Tabulation for preparation of the various requisite reports. The editing task has been successfully tried out on SEAC, and the automatic checking of the raw data to produce corrections, correspondence and the desired tabular reports is now being programmed.

### *A Cooperative Project*

Under a cooperative project with the Patent Office aimed at ultimate mechanization of patent searching, a general-purpose topological search routine was prepared and successfully demonstrated using SEAC to search through the encoded data on 250 chemical compounds in response to coded questions. The data file was transcribed on magnetic tape and then subjected to a data-checking routine which eliminated compounds with data errors in coding or punching. When a question of the presence of certain specified elements was posed to the remaining file of 208 compounds, the routine caused SEAC to search each compound in turn for all combinations of the specified elements. Whenever such a pattern was found, the patent page and line numbers were automatically printed out.

(*Continued on page* 50)

# THE IMPACT OF MILITARY REQUIREMENTS on ELECTRONIC DEVELOPMENTS

By Col. Richard J. Meyer

Chief, Research and Development Division
Office of the Chief Signal Officer

THE MOST OUTSTANDING development during the past year by the Army is its general acceptance and broad application of electronic data processing equipments [EDP]. These devices had, heretofore, been considered for computers in fire-control systems and a relatively few other applications. Today our military supply system operating on a world-wide basis is becoming dependent on the successful and reliable application of this equipment. The horizons for its eventual application seem unlimited and far-reaching.

### *Military Can Take No Chances*

I have just learned that a big department store in Cleveland has an electronic computing system which will perform the most phenomenal things. When a customer buys "X" items, the salesman records the sale on the cash register, indicating whether it is cash or charge plus other essential data; the stock control room automatically debits the inventory by stock number; at the billing office the customer's account is charged, and periodically, inventory and billing strike a total. The only manual operation is to put the requisitions or bills in the mail box. Now in a big store, there are many cash registers and considering that these all feed into one central computer, this becomes a truly outstanding and understandable machine.

Let us assume that one transistor in this EDP equipment gets tired and instead of printing "one" ten consecutive times, slips a gear and only prints "one" nine times. The results might favor the store or the customer. There obviously would be many complaints when the bills were received but no one would be hurt *physically*.

Consider, now, a missile—a missile of which we have produced thousands and upon the accurate performance of which the defense of our country is dependent.

Word comes from the computer inherent to the weapons system, of which this missile is a part, that a hostile target is within range. The missile is fired but New York City is splattered. Why? Because the computer threw nine instead of ten "ones" and the missile, accepting the erroneous data, missed its target. In this case an unreliable component can mean our destruction. In a weapons system comprising a mechanical-electronic complex, every component *must be reliable.*

The foregoing comments were introduced merely to stress the point that the military can take no chances. The military must have reliable components and the requirements for reliability are most rigid.

In the department store, the environment is, for practical purposes, constant. Consider the problems the military face: temperatures from —80 degrees F. to +165 degrees F., or higher; pressure from normal atmospheric to, in the case of missiles, unknown; acceleration from 0 to 40,000 g's; contamination from pure air to intense neutron and gamma radiations; vibration of widely varying frequency and amplitude. These are the military problems.

In spite of these exacting complexities, let us now consider the progress, trend, and future promise of electronic components in general but with specific attention to the transistor.

From the announcement of the discovery of the transistor in June of 1948, progress in the electronic field in the military has been phenomenal. No sooner does the military decide to employ a transistor in circuit *a*, than someone in industry announces a better transistor for the same circuit or another to replace the tube still being used in circuit *b*. The result—not chaos but procrastination and ultimate delay. Why? Because industries' engineers and the military —proud of their professional standing—do not wish to be in the position of designing obsolescent equipment. Furthermore, eager to lead the field, they quickly realize that with this latest transistor which industry just announced they can do many more things for the same price, considering size and weight only, than was initially predicted. This might bring them an added laurel. Saying it another way, progress in solid state devices has been so rapid that design engineers cannot keep up with the component development. So many new and intriguing components have recently become available that engineers are like children at Christmas —they don't know which toy to pick up first.

Nevertheless, the Army, as a matter of policy, has been in the process of transistorizing each equipment for which this is feasible. In fact, for combat area use (for receivers and low power transmitters up to 70 megacycles frequency) the policy has been not to use vacuum tubes if transistors can do the job.

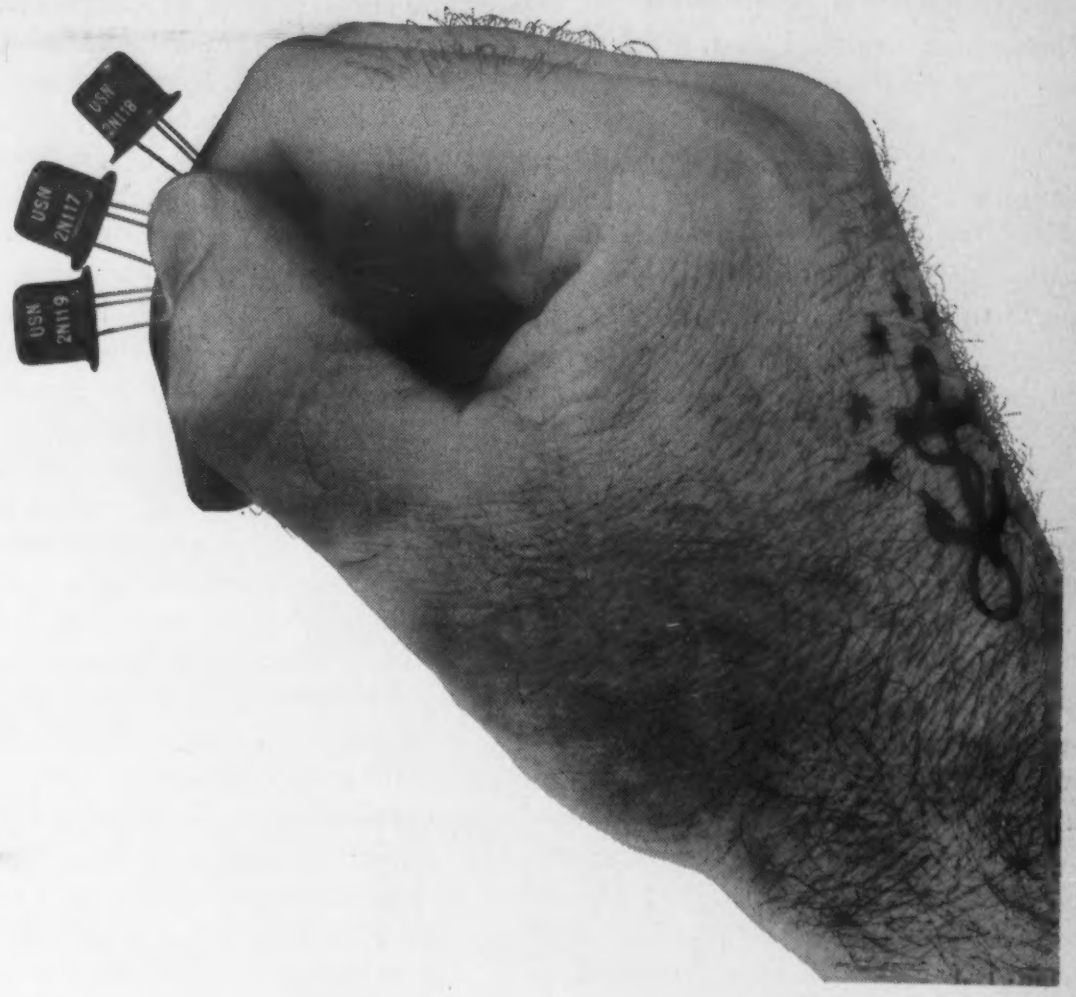
### *Much Time Is Required*

At the present time the Army has only one completely transistorized equipment in actual production. It must be realized that five to seven years are usually required for experimental breadboard models to reach the production phase. There are 12

(*Continued on page* 28)

TI PROGRESS REPORT ON MILITARY TRANSISTORS

# FIRST silicon transistors meeting NAVY SPECS




For *reliability* under *extreme* conditions... design with TI's military silicon transistors... built to give you high gain in small signal applications at temperatures up to 150°C. Made to the stringent requirements of MIL-T-19112A (SHIPS), MIL-T-19502 (SHIPS), and MIL-T-19504 (SHIPS) — these welded case, grown junction devices furnish the tremendous savings in weight, space, and power you expect from transistorization... *plus* close parameter control that permits you to design your circuits with confidence.

All 20 Texas Instruments silicon transistor types have proved themselves in military use. First and largest producer of silicon transistors, TI is the country's major supplier of high temperature transistors to industry for use in military and commercial equipment.

**degradation rate tests for TI's USN-2N117, USN-2N118, and USN-2N119**

| test | condition | duration | end point at 25°C |
|---|---|---|---|
| lead fatigue | three 90-degree arcs | — | no broken leads |
| vibration | 100 to 1000 cps at 10 G | 3 cycles, each x, y, and z plane | $I_{CO}$ = 2 $\mu$A maximum at 5V |
| vibration fatigue | 60 cps at 10 G | 32 hours, each x, y, and z plane | $h_{ob}$ = 2 $\mu$mhos maximum |
| shock | 40 G, 11 milliseconds | 3 shocks, each x, y, and z plane | $h_{fb}$ = −0.88 minimum (USN-2N117) |
| temperature cycle | −55°C to +150°C | 10 cycles | $h_{fb}$ = −0.94 minimum (USN-2N118) |
| moisture resistance | MIL-STD-202 | 240 hours | $h_{fb}$ = −0.97 minimum (USN-2N119) |
| life, intermittent operation | $P_c$ = 150 mW, $V_c$ = 30V | 1000 hours, accumulated operating time | |
| life, storage | 150° C, ambient | 1000 hours | no mechanical defects interfering with operation |
| salt spray | MIL-STD-202 | 50 hours | |

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## Electronic Computing Industries

(*Continued from page* 14)

been much oversold, but I do think the *over optimism* of engineers and scientists, in connection with the field, is a definite fact. This optimism causes serious complications. If an industry or the Department of Defense relies upon estimates of delivery and performance which are made by engineers, they must have some degree of confidence in the technical and financial judgment involved. There have been too many cases of long delays in the delivery of vital equipment on time, even though it may operate at only one-half the speed which may be technically feasible.

### *Engineering Manpower*

Another aspect of the industry which should be considered rather seriously is that of *engineering manpower*. On the basis of scientific optimism, the Defense Department is pursuing many projects in electronic computing. These projects result in many contracts with private industry. The usual procedure following the award of one of these major contracts is for any industry to proselyte engineering personnel from its competitors. As a result there is an inflationary spiral of salaries for engineering and scientific personnel. It may be well to say that a man is worthy of his hire. I do not subscribe completely to this point of view. It is within the power of technical people to assist in rectifying the situation, and thereby avoid the loss of a great deal of dignity in participating so actively in this mad scramble for personnel. Proper action on their part will provide tremendous assistance to the national defense in assessing proposed employment changes, not only on the basis of salary, but on the basis of the technical merit of the projects concerned and the potential achievement in a technical sense. It is certainly their responsibility to see that our industrial and defense program is on a sound basis.

These criticisms of over-optimism and personnel instability are not designed to detract tremendously from the achievement of technical people over the past ten years in the creation of a tremendous industry which is one of the important elements of our national defense. There are many excellent achievements which bear witness to the continued dynamic advance in the art as well as the industry. However, the soundness of their position in American economic life is clearly dependent upon *personal integrity*. Therefore, more attention should be given to the two points made with respect to dependability in the matter of prediction of achievements in regard to time, money and engineering manpower.

### *Participation in Fundamental Problems*

The great German novelist, Thomas Mann, once said, "What perplexes the world is disparity between the swiftness of the spirit and the immense unwieldiness, sluggishness, inertia, permanence of matter."

As far as the arts with which we are concerned, this statement may well be reversed. We have developed computing equipment of tremendous speed and capacity and what perplexes the industry and the Department of Defense is the sluggishness of the human spirit in participating in their fundamental problems.

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## Impact of Military Requirements on Electronic Developments

(*Continued from page* 26)

equipments now in the pre-production or service test stage. It is expected that when these models go into production—in approximately two years—five million transistors will be used for the initial production. In addition, 59 equipments are now in varying stages of development and will probably be in a production status in three to five years. One can guess that they will probably utilize 100,000,000 transistors. An estimate as to the number of transistors the Army will eventually use is very much dependent upon the world situation, appropriations from Congress, and the state of the transistor and component art. However, if one uses the present programs as a criterion, the quantities of transistors for use in military equipments is still exponentially increasing. In the event of partial mobilization similar to the Korean conflict, the expected use would be 10,000,000 transistors just for portable radio equipment, such as the Walkie-Talkie.

The most promising developments for immediate transistor application are in the fields of carrier, switching equipments, and computers where large quantities of these devices will be utilized in single equipments. However, many transistors will be used in power supplies, short range portable radio sets, portable television cameras, facsimile equipments, beacons, etc. In addition, the Ordnance Corps is making maximum utilization of transistors in their missile programs now under active development.

### *Improvement of Technique*

The transistor will, without a doubt, be one of the principal components for automatic assembly and printed circuit techniques. Work is still needed in the automation field to improve the technique for utilization of transistors. It seems that the transistor is too small for automatic assembly processes now in use and that the package, of which it is a part, has been designed larger than is necessary.

Since the advent of the transistor in 1948, the Army Signal Corps has been a leader in all the programs encouraging and expanding the transistor art. In the past fiscal year, about $15,000,000 was contracted with major transistor manufacturers for feasibility studies, development of diffusion type transistors, and research in solid state devices.

Listed below are a few of the items currently in development and an indication of the quantity of transistors the Army expects to use per item:

| | |
|---|---|
| Multiple Target Coordinate Data Set | 300 |
| Single Target Coordinate Data Set | 235 |
| Teletypewriter Set, Electronic | 345 |
| Frequency Meter | 98 |
| Central Office Switchboard, Automatic | 4300 |
| Converter, Digital Data | 110 |
| Switching Center, Teletypewriter | 2000 |

In this short discussion, an attempt has been made to indicate the Army's need for reliability of electronic components, the trend of its electronic development program, and the impact of military requirements in the nuclear age on electronics development.

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PIONEERING SCIENTIFIC FRONTIERS AT GENERAL MILLS

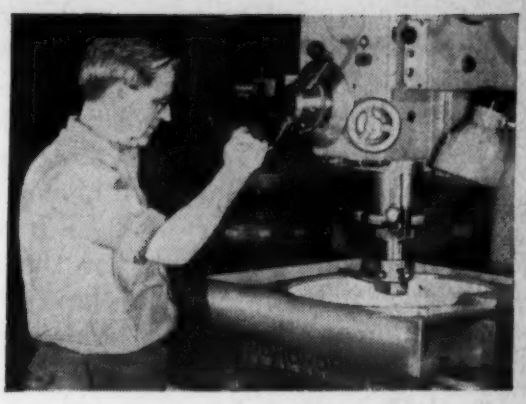
Dr. J. E. Barkley, director of research, takes a reading in the dark tunnel during study of new infrared techniques being conducted by the Mechanical Division of General Mills.

# What else can infrared do?

Infrared detection devices have become almost commonplace. These invisible rays are now used in photography and several other industrial and military applications. But the full capabilities of infrared have not yet been determined. Dr. Barkley and his staff, working from an extensive background in current uses of infrared, are researching several possible applications right now.

These studies in basic infrared technology represent but a single phase of General Mills' over-all program of advanced exploration in theoretical and developmental physics, electronics and mechanical design.

*Findings in this "research for tomorrow" are being translated regularly into practical applications for industrial and military use today. If you have product or production problems, you can profit from these applications, and from our high-level production facilities.*



**CAN YOU BENEFIT FROM HIS SKILL AND EXPERIENCE?**

Skilled craftsmen, who are as proud of the precision products they produce as they are of the highly specialized machines they use, work with exacting care which comes only from many years of experience. Mass production and on time delivery of electro-mechanical and mechanical devices is routine at General Mills.

**Send for Production Facts** New booklet shows our facilities, names our customers—introduces you to on time, precision manufacturing. Write Mechanical Division, Dept. SG-3, General Mills, 1620 Central Ave. N. E., Minneapolis, Minn.

**MECHANICAL DIVISION**

*CREATIVE RESEARCH AND DEVELOPMENT + PRECISION ENGINEERING AND PRODUCTION*

General Mills

# The Part Played by Training in the Story of ELECTRONICS

**by RAdm. DWIGHT M. AGNEW, USN (Ret.)**

**Vice President for Public Relations**
**Capitol Radio Engineering Institute**

WHEN YOU THINK OF THE STORY of Electronics and its related industrial development your natural tendency is, perhaps, to think of the major inventions and discoveries, and of the men who invented or discovered them. Such a list might include Benjamin Franklin and his kite, Thomas Edison and the "Edison Effect" as well as his carbon filament, Marconi and his first successful transoceanic wireless, or DeForest and his triode vacuum tube; all these in the line of early discoveries and inventions. Or if you think of military communications, you probably think of Admiral Hooper, the "father" of Navy Radio, and General George O. Squire who, because of his visionary "wired wireless," might be called the "father" of Army Communications. Or if you are in the industrial field, you might think of Allen DuMont and his promotion of the cathode ray tube, or W. R. G. Baker of General Electric, or Colpitts and Hartley of Bell Laboratories, or Kolster of Mackay Radio and Telegraph, or Sarnoff of RCA, or dozens of other names, all leaders in their field. But what really made it possible for the electronics industry to develop to the position of eminence it holds today?

### *"Hams" Stimulate Growth*

The idea of radio had captured the minds of men, thus motivating the early "Hams;" few in number at first, but increasing over the years to the tens of thousands we now have. (Many of the early "Hams," by the way, are among the leaders in the electronics industry today.) The ever-increasing number of people keenly interested in electronics provided considerable growth-stimulus to the industry. Added to this, the war and its resulting vast military requirement provided further stimulus of such urgency that the rate of growth was bound to be explosive. The nucleus of trained technicians plus the training capacity afforded by the Nation's Technical Schools and Institutions prevented this extremely rapid growth from becoming chaotic. And so to round out the story of electronics, we need to tell something of the training aspects. The whole story cannot be told without mentioning how many "Hams" and other thousands of ambitious individuals got the necessary training to provide the skilled technicians, first to permit the growth, then later to support the industrial giant electronics has become today.

### *CREI Pioneers in Technical Training*

Just as there were pioneers in the field of discovery and invention, so also there were pioneers in the field of electronic training. In this field Mr. E. H. Rietzke, the founder and President of Capitol Radio Engineering Institute, has earned a similar position of eminence. Mr. Rietzke and his role in establishing the first advanced course in radio is synonymous with the CREI Story. The start of the CREI Story really begins in 1924 when he came to Washington, as a Chief Radioman, to establish the Navy's famous "Bellevue Course" at the Naval Research Laboratory. The development of that course took three and one-half years, and for the next twenty years it was the foundation of all the courses prepared for the thousands of electronics people the Navy trained and developed. This course, organized and directed by Mr. Rietzke, was the first advanced vacuum tube course given anywhere.

In 1926 Radio Broadcasting was fast becoming a substantial business, so much so, that many of the civilian visitors to Bellevue expressed the thought that there was an urgent need for a similar course for the advanced training of radio technicians. This oft-expressed thought provided the germ of the idea that caused the establishment and growth of CREI. Upon seeing the need, Mr. Rietzke started preparation of the first CREI course in 1926. Having reached the decision to establish CREI, he decided to get out of the Navy in the spring of 1927. In June of that year he incorporated CREI. The Navy, however, persuaded him to continue at Bellevue for the next year, authorizing him to devote all of his spare time to his newly established school. In 1928 he left the Navy to give his full time to CREI. Even though the depression of 1929 came only a little more than two years after CREI's establishment, the school grew and prospered. The extreme job-scarcity of the depression made a good advanced Home Study course attractive to many ambitious young professional radiomen seeking the best possible means for self-improvement.

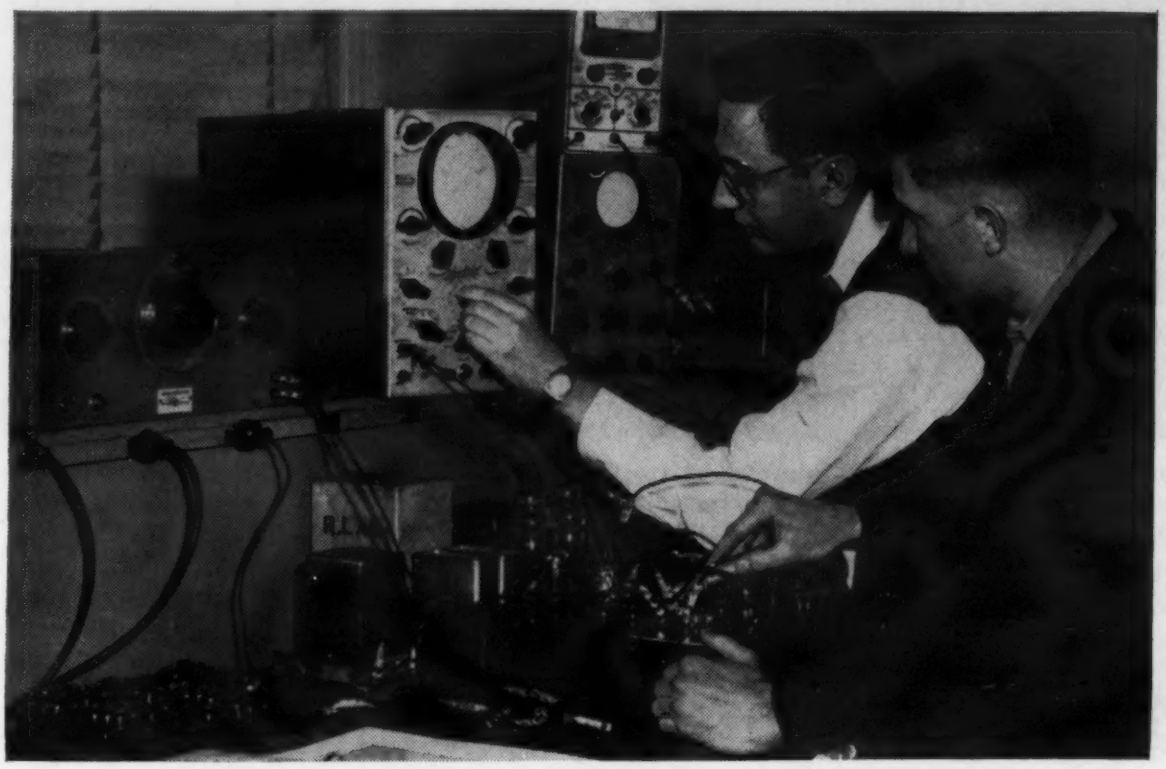
In 1932 CREI expanded its plant facility and its staff. It was at this time that the Residence School was opened. The initial Residence School course started with an intensive nine months program which firmly established CREI's reputation as an outstanding technical institute. It enjoys that reputation today. The curriculum of the Residence School now requires approximately twenty-eight months (three school years).

### *CREI Trains Thousands*

CREI is unique in the annals of technical schools in that it combines a Residence School in excess of 500 students and a Home Study or correspondence school of over 12,000 active students. Both the Residence School student and the Home Study student follow the same course and use identical texts, the only difference being that the Home Study student does not have the benefit of the laboratory work done by the Residence student. For this reason, he must be (or have been) actively engaged in some phase of the electronics industry; CREI cannot and will not enroll

Mr. Eugene H. Rietzke, Founder and President of the Capitol Radio Engineering Institute.


Executive Offices of the Home Study Division and the Residence School, located at 3224 16th St., N. W., Washington, D. C. Both day and night classes are conducted.



Students collect data on phase inverter experiment.

beginners in its correspondence program. The curriculums for both Residence and Home Study courses are accredited (and have been for the past eleven years) by the Engineers' Council for Professional Development. The ECPD is a body, composed of nationally recognized engineering and educational societies, whose function is accreditation of the curriculums of engineering colleges and technical institutes. Based on this accreditation, the Board of Education of the District of Columbia authorizes the award of an Associate Degree in Applied Science for successful completion of the CREI Residence School course.

Prior to World War II the Residence School was quite small—on the order of 50-60 students. However, in August 1941 the Army Signal Corps asked CREI to take a pilot class of 100 enlisted men to be trained as radio technicians. By July 1942 this activity had developed into a military enrollment of 875 Signal Corps students. During the winter of 1942-43 CREI built, established, and operated school facilities capable of training 1000 students, and feeding and housing 700. This was at Silver Spring, Maryland. After the completion of the Army Training contract, hundreds of Coast Guard technicians were trained there. In all, CREI trained approximately 5000 men for the Army and the Coast Guard. Also during the war, thousands of trained electronics technicians were needed by the war industries. This CREI helped to accomplish by operating under contract as a Branch of the University of Maryland in the ESMWT program of the U. S. Office of Education. To meet the Navy's great war-time need, CREI also prepared a special correspondence course for Navy Radio Technicians, using material already available in its standard courses. 320,000 lesson assignments were supplied to the Navy. Since the war, literally thousands of ex-GI's have taken CREI courses, Residence and Home Study, under World War II and the Korean Bill of Rights. The present home study enrollment includes several thousand active military electronics personnel.

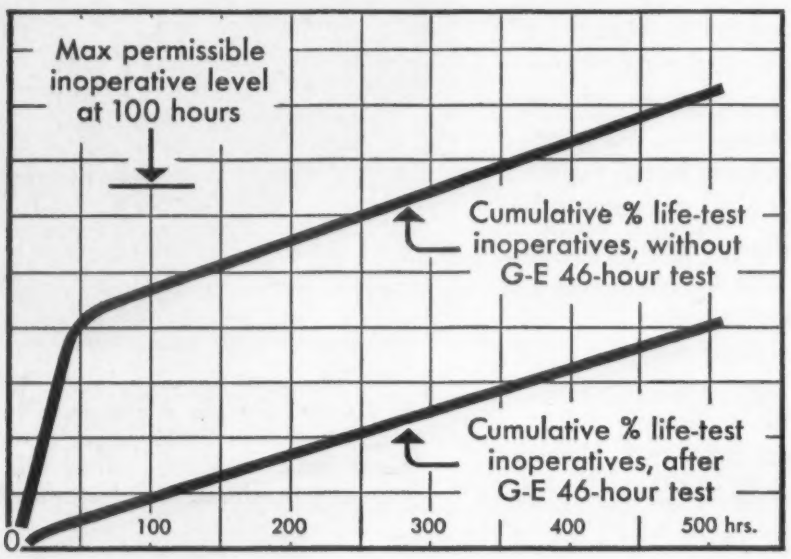
Over the years CREI has maintained its position of leadership by always keeping abreast of the fast-growing electronics industry. Evidence of the high esteem industry places on Capitol Radio Engineering Institute training is amply demonstrated by the dozens of Group contracts and Company-sponsored training plans the leading companies in the electronic and aviation fields maintain with CREI. Some of these programs are with small companies involving a few students; others are with large companies in each of which hundreds of students are enrolled. Some of the plans have been in operation up to ten years. Thus CREI, now in its thirtieth year, looks forward to continuing to serve in the field of electronic training for industry and for all of the various Military Services.

The 173 lessons in the complete CREI Home Study Course provide a complete reference library. More than 5,000 pages of text matter comprise the volumes. They are revised and modernized constantly.

General Electric technician checks 5-Star Tubes on special 46-hour inoperative control test, designed to reduce early-life failures. His lint-free, white Nylon garb marks this process as part of Operation Snow White—General Electric's all-out program to exclude from 5-Star Tubes any impurities that can cause short circuits or impair electrical efficiency.

# Special G-E 46-hour inoperative control cuts 5-Star Tube failure rate, assures top dependability!

To weed out early-life failures, General Electric operates *all* 5-Star Tubes for 46 hours *prior to* final life testing and shipment. This special G-E procedure joins with impurity-free Snow White tube production to increase reliability and assure full service life. Benefits of General Electric's 46-hour inoperative control procedure are seen clearly from the life-test chart that follows.




Note that the inoperatives in any lot of 5-Star Tubes on life test are only half as many, at 500 hours, as they would be without G-E inoperative control. Furthermore, at 500 hours, the percentage of inoperatives is still far below the permissible figure established for 100 hours.

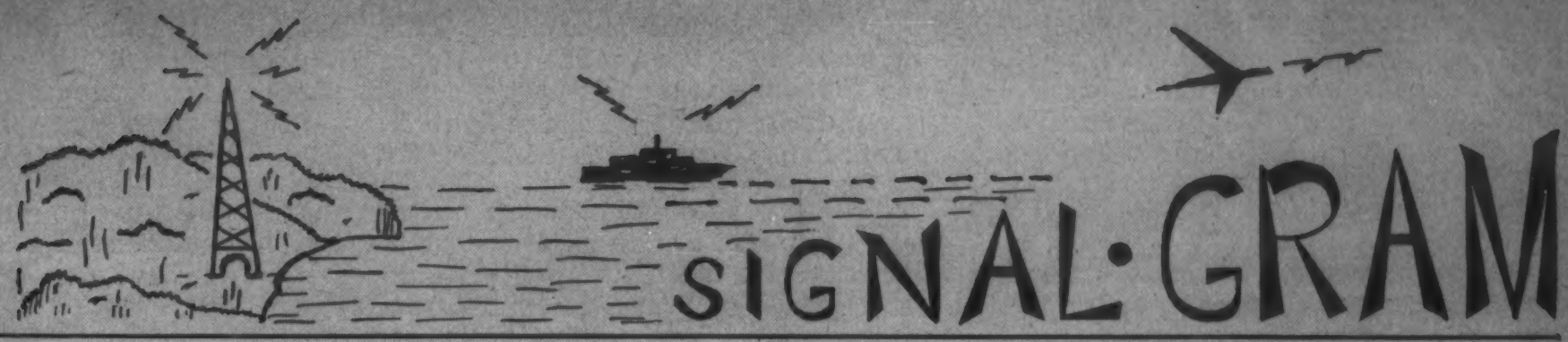
46-hour inoperative control procedure helps make General Electric 5-Star Tubes the most reliable you can install. Added to special rugged design, Snow White cleanliness in manufacture, and rigid, extensive tests, this special G-E procedure further minimizes tube failure possibility and safeguards electrical performance.

Specify G-E high-reliability 5-Star Tubes when ordering new military electronic equipment! Use them as replacements! *Electronic Components Division, General Electric Company, Schenectady 5, N. Y.*

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

164-1A2




## — GOVERNMENT —

RESULTS OF GOVERNMENT RESEARCH AVAILABLE Non-classified results of Government-financed scientific research are being turned over to American science and industry through the Office of Technical Services (OTS), Department of Commerce. Most Government research is devoted to strengthening the Nation's defense potential through developments in aeronautics, metals, chemicals, plastics, electronics, foods, fuels, instruments, leather, rubber, ceramics, textiles, atomic energy, and other industrial fields. Two monthly periodicals called "U. S. Government Research Reports" ($6) and "The Technical Reports Newsletter" ($1), advising of new material released, may be ordered from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

ATOMIC HEAT FROM SOLAR FURNACE The Army recently announced that a giant-size solar furnace capable of concentrating the sun's rays to produce temperatures comparable to those generated by an atomic explosion will be erected at the Quartermaster Research and Engineering Center, Natick, Mass. A solar furnace collects the sun's rays and concentrates them into a small target area in much the same manner as a "magnifying glass" may produce a very hot pinpoint focus. The furnace will have energy equivalent to 28 kilowatts. It will be utilized for laboratory testing of materials intended for the protection of military personnel against the thermal effects of nuclear and other weapons and is expected to reduce the time and cost of developing heat-resisting materials.

CONTRACT AWARDS The ARMY has awarded the following contracts: Roanwell Corp., microphone headset, $237,361; Cook Research Laboratories, recording system, $68,205; Stewart-Warner Corp., radio teletypewriter set, $2,415,948; General Cable Corp., telephone cable, $1,480,947. The NAVY announced recently contract awards to: Norris-Thermador Corp., three-inch .50 caliber ammunition, $1,389,321; Bethlehem Steel Co., overhauling and altering a Navy landing ship dock, $1,375,000; Ingalls Shipbuilding Corp. and General Dynamics Corp., nuclear-powered submarines, total of $41 million; Temco Aircraft Corp., development of a new guided-missile weapon system, $16,000,000. AIR FORCE grants include: Solar Aircraft Co., facilities for J-57 engine components, $1,300,000; Stewart-Warner Corp., communications equipment, $4,844,794; Boeing Airplane Co., facilities to produce B-52 bombers, $6,879,500; General Electric Co., radarscope camera systems, generator systems and parts, totaling $3,486,577; Recony Corp., air-conditioners, $2,476,362; Collins Radio Co., ultra-high frequency ground communication equipment, $9.9-million; Bendix Aviation Corp., wheel and brake assemblies for F-104 jet aircraft, $4,131,450; Lear, Inc., aircraft control and indicator parts, $2,556,750; Sundstrand Machine Tool Co., F-106 jet fighter spare parts and ground support equipment, $3,213,703; Cersci & Son, Inc., cargo trucks, $2,061,856; Temco Aircraft Corp., modification of RB-50 aircraft, $1,056,963; Standard Coils Kollsman Instrument Corp., Automatic Astro Compass, $26 million; Martin, Convair, and Douglas Aircraft Companies, for design fabrication and testing of three missiles, The Atlas by Convair, $145,000,000; The Titan by Martin, $358,000,000 and The Thor by Douglas, $67,500,000; Ford Instrument Co., Division of Sperry Rand Corp., ASN-7 navigation system, approximately $15 million.

## — INDUSTRY —

INSTITUTE OF RADIO ENGINEERS NATIONAL CONVENTION Time: 10 A. M. to 9 P.M., Monday through Thursday, March 18-21. Place: New York Coliseum, Columbus Circle, Manhattan. Events: 840 exhibits, 55 outstanding sessions, annual banquet, cocktail party, annual meeting, women's program.

SATELLITE ROCKET PRIMED FOR DELIVERY General Electric Co. officials have revealed that the "Vanguard" rocket engine "X-405," which will propel the proposed three stage earth satellite the first 36 miles into outer space in 2½ minutes, is ready for delivery. The engine will be delivered to the Martin Co. of Baltimore, which has been selected by the Navy as the prime contractor for the satellite.

PLANS OF AMERICAN ROCKETEERS Plans for 1957 will include a large aircraft-launched Rockaire and an auxiliary rocket engine for jet aircraft. Rockaire, developed by Douglas Aircraft Co., is an upper-air research vehicle to be fired vertically from an F-86D sabrejet. The rocket engine being developed for the Navy is to give conventional jet airplanes increased performance at high altitudes.

COMMERCIAL PILOTS TO TRAIN FOR JET AGE American Airlines, in preparation for the jet age, has on order 35 Lockheed Electra prop-jets for short and medium range routes, and 30 Boeing 707 turbo-jets for transcontinental and other long-range operations. For early 1958 delivery, two flight simulators, one for each jet type, has been requested from Erco division, ACF Industries, Inc. The simulators will duplicate the cockpits of the two jet models in every detail and will be able to simulate every possible flight situation or any operational aspect of either airplane to the most minute degree. By the time the jets are delivered, these units will have enabled the airline to train its pilots thoroughly in the various flight characteristics of the two airplanes, thus smoothing the transition from piston airplanes to jets.

NEW RADIO INTERFERENCE BLANKER Hoover Electronics Co. has recently developed a radio interference blanker which will improve the ability of pilots of high-speed, high-performance aircraft to maintain communications with the ground. The blanker has been described as a rapid electronic switch which actually disconnects the antenna from the receiver when the amplitude of the signal out of the antenna oversteps a definite threshold. The associated receiver is not subjected to high-intensity bursts of static when the blanker is in operation.

"FAIR TRADE" LAWS UNENFORCEABLE Graflex Inc. and Bell & Howell Co., large makers of photographic products, recently joined Eastman Kodak and ended all "fair trade" agreements of cameras, films and other photographic products because of the difficulty of enforcing the law in the states where it exists and the continuing disintegration of individual state support.

COMMUNICATIONS ROLE IN FIRST NON STOP-JET FLIGHT Collins Radio Company played an important communications role in the historic first non-stop jet flight around the world Jan. 18. Voice communication was maintained at all times with the giant B-52's from ten ground stations using a transmission technique known as single sideband. The Collins company installed the ground equipment used during the flight and is currently developing for the Air Force a new inter-continental air-to-ground system using these principles.

## — GENERAL —

NOL CRYSTAL LABORATORY In the relatively new field of solid state physics, the crystal is being put to new uses in order to explore the complex structures of solids. The Naval Ordnance Laboratory is developing new types of crystals, principally for studies of their magnetic properties. The main interest to NOL is in their possible use in UHF electronics equipment as transformers and antennas or in the memory units of electronic computers.

YESTERDAY'S SCIENCE FICTION IS TODAY'S SCIENCE FACT General Electric experts believe that four satellite stations, travelling 4000 miles high over the equatorial section of the earth, can serve as relays to offer world-wide TV coverage. The satellites would be equally distant from each other and visible at any instant from the earth's equatorial region. TV signals could be transmitted from a ground location to the nearest satellite. Present-day technology indicates that the satellites would require only good quality receivers and transmitters to make the system function properly.

ARMED FORCES DAY, MAY 18 The tenth anniversary of military unification and the fiftieth anniversary of military aviation will be keynoted in the 1957 observance of Armed Forces Day, May 18, 1957. Both anniversaries to be observed this year are teamed under POWER FOR PEACE which has been the Armed Forces Day slogan since it was first used in 1953. The Post Office Department plans to issue a special stamp to commemorate the fiftieth anniversary of military aviation.

ULTRASONIC WAVES HELP BURSITIS Ultrasonic waves from a machine with a "sounding head" operating at a frequency of one million cycles per second are being used to combat the pains of bursitis, according to Dr. F. F. Schwartz, associate professor of clinical medicine at the Medical College of Alabama. Ultrasonic therapy produces better results than any other form of heat application. The waves give the patient a "micro-message" which is both physical and bio-chemical.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Because the present nationwide navigation system for civil aircraft, called VOR, already provides the directional information, the government's Air Coordinating Committee decided to add the *distance measuring* feature of TACAN—creating a *new* integrated system called VORTAC. Soon all aircraft—private and commercial as well as military—will receive *complete* navigational information from either TACAN or VORTAC.

In the skies, over the seas, and in industry . . . the pioneering leadership in telecommunication research by IT&T speeds the pace of electronic progress.

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VORTAC airborne equipment is now available. For detailed information write to Federal Telephone and Radio Company, a division of IT&T, Clifton, N. J.

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**INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, 67 Broad Street, New York 4, N.Y.**

# COMMUNICATIONS GO ON A SAFARI

## *with Arthur Godfrey*

HAVE YOU EVER KNOWN ANYONE who was satisfied with what he did? If you have, pause and consider why he was satisfied. Was it because he already was well off and only needed to hold on to his accomplishments to be happy? Was it because he conquered the unusual and overcame obstacles, thereby, gaining a feeling of greatness and importance? Was it because a man of distinction in our times overcame the hardships of life and in so doing endeared himself to millions of people? If you are thinking in terms of greatness through accomplishments, charitable actions and love of people, then you may very well ask this question. In all the mighty outbursts of genius that mark the beginning of modern times, who was the greatest man? One person might say, Columbus, discoverer of America; another, Michelangelo, the original genius of the Renaissance; still another might say the Good Samaritan of Biblical days; a military strategist might say Napoleon; a communicator, Marconi or DeForest. Who is to judge?

Today, SIGNAL magazine evinces an interest in another man by the name of Godfrey. Mr. Arthur Godfrey, whose accomplishments in many fields can be recorded already as history. Be this as it may, Mr. Godfrey is about to fulfill another one of his lifelong dreams—a series of which have been nothing short of miraculous. Now he takes off on a "safari into the interior of darkest Africa." Being the man that he is, Mr. Godfrey wants each and every one of his friends to go along with him. This he has planned through the medium of communications. His prodigious efforts to utilize the wonders of the electronic age have been finalized and we, his television and radio audience, will be given the privilege to view and live the experience of this humble gentleman. All we need do is to tune in on Mr. Godfrey's scheduled broadcast time over CBS radio and television.

### *Via Air France*

Leaving via Air France, Mr. and Mrs. Godfrey will celebrate their 19th wedding anniversary in Paris. Mr. Godfrey's plane will be flown to Madrid by his co-pilot, Mr. Frank LaVigna and Captain John Armstrong.

From Madrid the party will fly to Majorca, in the Balearic Islands, for re-fueling and thence to Tripoli, in Libya, where the plane will be thoroughly checked prior to the long haul across the Sahara to Fort Archambault, French Equatorial Africa.

### *Shortwave from Africa*

Mr. Godfrey will broadcast from the jungles of Africa by means of an Eldico 1-KW shortwave transmitter. By changing the crystals of the transmitter, he will be able to transmit on any of four frequencies which have been loaned to him by Radio Corporation of America with the sanction of the Federal Communications Commission. Power for the transmitter is provided by a 2½-KW Onan generator driven by a gasoline engine, which will be hauled by jeep and which will, in addition, run ice machines, electric razors, electric lights, etc. The same equipment, less the Onan generator, will be carried on his "One Mike" enabling Mr. Godfrey to broadcast from his airplane. The broadcasts will be made on whichever of the four frequencies conditions will permit him to use. The shortwave transmissions will be picked up at Rocky Point, New York, by RCA and then relayed to CBS for

Mr. Godfrey is pictured here at the controls of his DC-3. This plane will be flown to Madrid by Frank LaVigna and Captain John Armstrong, his co-pilots. From there the Godfrey party will fly to Majorca, in the Balearic Islands, and thence to Tripoli in Libya, where the plane will be checked thoroughly prior to the long haul across the Sahara to Fort Archambault, French Equatorial Africa.

re-broadcast on Mr. Godfrey's regular radio and television programs.

It is understood that General Curtis E. Lemay, Commanding General of Strategic Air Command, is making plans which may allow him to accompany Mr. Godfrey. If this becomes an actuality, General Lemay will enjoy his first vacation in twenty-five years. If world conditions permit and the pressure of SAC duties eases sufficiently, Gen. Lemay may go on leave at one of the overseas bases. Under current planning, the Godfrey party would be granted permission to land the DC-3 at the base to pick up Gen. Lemay. At the end of the hunting trip, Gen. Lemay would be returned to the SAC base to resume his work.

### *22 Years in Broadcasting*

Arthur Godfrey has spent more than twenty-two years in broadcasting and has become one of the best loved and most-listened-to and seen personalities in American history. His weekly audience is estimated at more than forty million people. He founded the GAPSALS (Give A Pint, Save A Life Society) in 1944 and through his appeals, aired locally in New York, more than 6,000 pints of blood were collected. As a Navy war correspondent he flew to Saipan to witness uses of blood plasma he was collecting. In 1951 he ran a 15-hour Blood Pledge Marathon on the CBS Radio Network. As a result of his appeals, more than 300,000 pints of blood were pledged.

Godfrey was promoted in 1950 to Commander, USNR, after having been a Lieutenant Commander since 1939. Winning the golden wings of a naval aviator was his biggest thrill. An exponent of safety in flying, he is also one of the aviation industry's best ambassadors of good will. He has provided scholarships at American University in Washington, D. C., to train students in flying and other aspects of aviation. The Air Force Association honored him with a plaque for "distinguished public service contributing to a greater understanding of air power . . . . and proving the efficiency of air travel."

Many people have noticed Mr. Godfrey limp at times. The story behind that is an inspiration to all who have physical handicaps to overcome. In 1931, he suffered 47 fractures in an automobile accident. It took him years to learn to walk again unaided. Today he flies planes, rides horses, ice skates, and now is off on a safari to Africa.

SIGNAL magazine wishes Mr. Godfrey good luck and a bon voyage. We look forward with interest to his broadcasts from Africa and wish to thank him for the opportunity which he has given us to bring you the above story relating to the fulfillment of his dreams.—The Editor.

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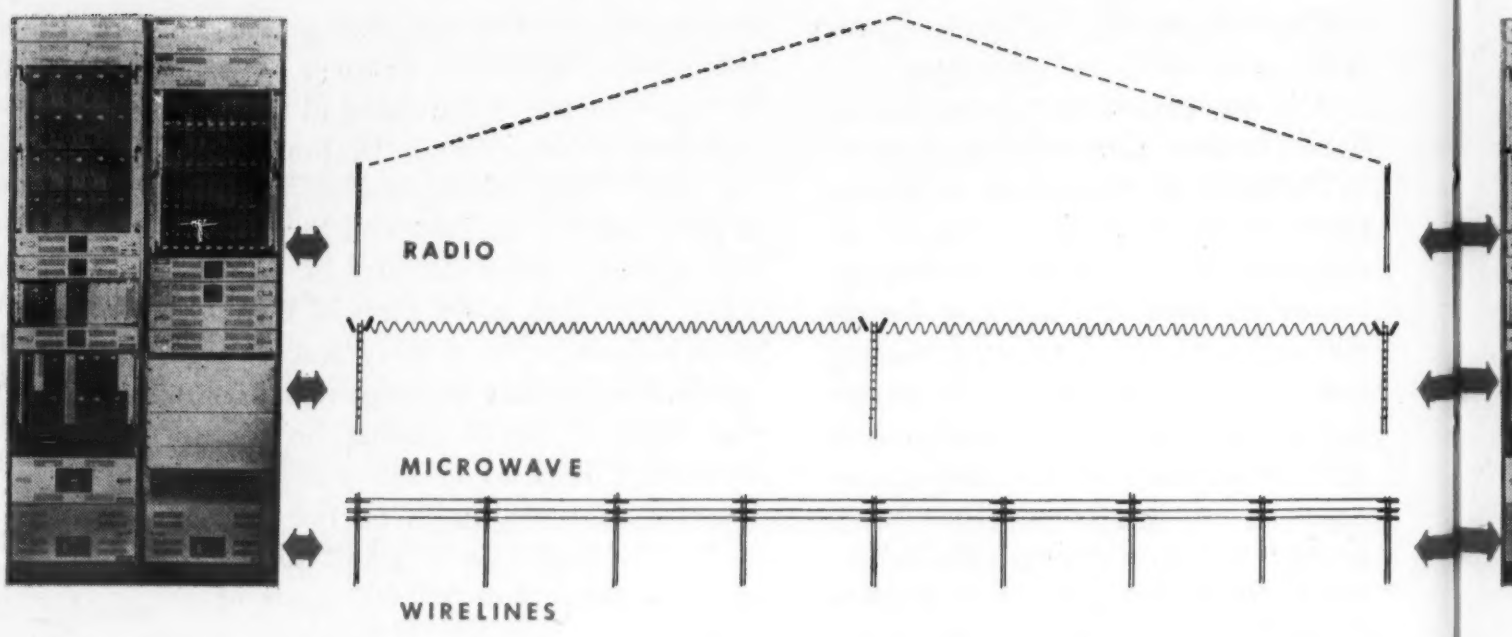
combination of the two.

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Another major stride forward in communication. From the research and development laboratories of Collins Radio Company comes KINEPLEX — a spectrum conserving, high-capacity, synchronous data system which transmits and receives 3,000 bits of information per second on a 3 kc band, with superior signal-to-noise performance.

Adaptable to wireline, cable, radio, or microwave facilities, KINEPLEX provides twice as many channels on a 3 kc band as present day carrier teletypewriter systems. In teletypewriter applications this means 40 channels on a 3 kc band at 60, 75, or 100 words a minute operation.

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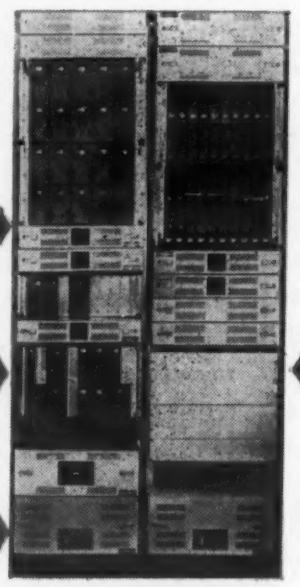
KINEPLEX can also be used for telemetering, supervisory control, and facsimile. The total data transmission capacity of the system can be divided between various services to fit specific applications. Write today for literature on Collins new TE-202 KINEPLEX Data System.



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a 3 kc bandwidth, or a
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# Collins also leads development in the fields o

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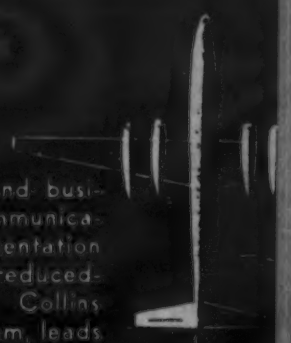
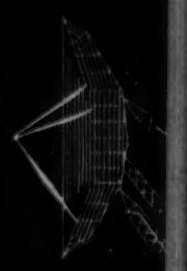


Collins completely outfits airline, military and business aircraft with the most advanced communication, navigation, flight control and instrumentation systems in aviation. Many new lightweight, reduced-size versions are now being delivered. Collins designed the original Integrated Flight System, leads in combining comm/nav/ident units into a single compact "CNI" package for new military aircraft, and continues to pace the industry in developments in airborne radar, ADF, ILS, VOR, HF and VHF communication.

## GROUND COMMUNICATION



Collins engineers, designs and supplies the equipment, installs, and puts into operation integrated point-to-point communication systems of any scope. The Collins system engineering staff is backed by the finest equipment in the world, whether standard MF, HF or VHF, Transhorizon "scatter," microwave relay and multiplex or single sideband HF. Typical of Collins communication progress is "Kineplex" — a high speed data transmission system doubling communication capacity.

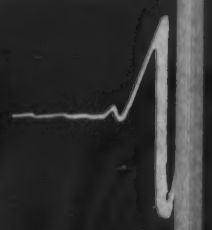
## AMATEUR RADIO

In the early 1930's Collins set the standard in Amateur radio and, through continuous design and development, has raised this standard to its present single sideband station — the most honored and prized in the Amateur fraternity. This station is the top performing rig on the air with its kilowatt KWS-1 transmitter and highly selective 75A-4 receiver. Many of the leaders in the electronics industry became acquainted with Collins through the Company's superior Amateur equipment.

## BROADCAST

Collins supplies a complete new AM station from mike to antenna or modernizes existing facilities. Besides the superior line of transmitters, Collins supplies the broadcaster's needs with such advanced additions as TV-STL microwave relay system, the lightest 4-channel remote amplifier on the market, phasing equipment and audio consoles. Collins field service organization has built an enviable reputation in assisting the broadcaster in installation or in times of emergency.

## COMPONENTS AND TEST EQUIPMENT



The degree of precision and reliability of Collins products requires development by Collins engineering of components such as Autotunes and Autopositioners, Mechanical Filters, oscillators, heat reducing tube shields and ferrites. These developments and other high quality components are sold by a Collins subsidiary, Communication Accessories Company of Hickman Mills, Missouri. The same principles of accuracy and reliability apply to Collins test equipment, built especially for Collins but adaptable to testing other equipment types.

# a TAX BILL OF INTEREST


## by Kennedy Watkins

**Tax Attorney**
**Washington, D. C.**


IN ACCORD WITH PAST PRACTICES, the first few days of the first session of the 85th Congress witnessed a large number of revenue bills being introduced in both Houses of Congress. Many of these are introduced "for the record"—for home consumption; some may never see the light of day as they lie forgotten in committee; some may be the subject of open hearings and in due course might ultimately be enacted into law. To prognosticate at this stage which of the bills introduced thus far may be ultimately enacted is impossible. However, it is not too difficult to spot certain of these measures which, in the light of their objectives and current conditions, are not only of interest but might have some measure of success in being enacted. Such a bill is S. 352, a bill to amend the 1954 Internal Revenue Code, so as to impose a graduated tax on the taxable income of corporations. This bill was introduced on January 7, 1957, by Senator Sparkman. A bill similar to S. 352 (S. 4138) was previously introduced by Senator Sparkman in the closing days of the last session of the preceding Congress.

### *Extension Study by Committee*

To place this bill in its proper setting, it must be noted that its sponsor has long been Chairman of the Senate's Select Committee on Small Business. This Committee has labored extensively in developing and studying the ills, and possible means of their cure, of small business. One of the many problems in this area which can be relieved by legislation concerns the financial and tax situation of small business. It was doubtless with this in mind that the Senator introduced S. 352.

Pursuant to the terms of this bill, in the case of taxable years beginning after December 31, 1956, the taxable income of corporations would be taxed as follows:

| | |
|---|---|
| Not over $5,000 | 5 percent of the taxable income. |
| Over $5,000 but not over $10,000 | $250, plus 10 percent of excess over $5,000. |
| Over $10,000 but not over $15,000 | $750, plus 15 percent of excess over $10,000. |
| Over $15,000 but not over $20,000 | $1,500, plus 25 percent of excess over $15,000. |
| Over $20,000 but not over $25,000 | $2,750, plus 35 percent of excess over $20,000. |
| Over $25,000 but not over $100,000 | $4,500, plus 45 percent of excess over $25,000. |
| Over $100,000 | $38,250, plus 55 percent of excess over $100,000. |

In substituting graduated taxes at the rates indicated for the present normal tax and surtax on corporate taxable income, this bill would, according to Senator Sparkman, "mean a tax saving to nearly 98 percent of all corporations." He goes on to point out that with the maximum rate of 55%, there would be an increase in taxes on about 2% of the corporations in the country today. Based on the rates set forth in S. 352, the staff of the Joint Committee on Internal Revenue Taxation estimates that there would be no loss in Federal revenue. "In fact," the Senator says, "it would bring about an increase in revenue in the neighborhood of ninety to one hundred million dollars." [Cong. Rec., 1-7-57, p. 255.] In the present fiscal situation, such a prognosis as this has considerable appeal. This, coupled with an expressed desire on the part of the Administration to help small business and realizing the "grass root" pressure which small business is capable of exerting, would seem to indicate that S. 352 is a bill to watch.

### *Remarks of Congressman Mills*

While considering the beneficial aspects of this proposed legislation, both as to small business and the Federal revenues, it must be recognized that all small businesses are not small corporations and, further, that the introduction of graduated rates on corporate taxable income is a new concept not free of potential hazards. In a recent speech before the Federal Tax Forum, in New York City, on December 6, 1956, Congressman Wilbur D. Mills, a member of the House Ways and Means Committee and Chairman of its Subcommittee on Internal Revenue Taxation, was careful to point out that the vast majority of small business in the U. S. is conducted as sole proprietorships or as partnerships. His remarks on this aspect of the problem are of such pertinence as to warrant repetition. In this connection, he said:

> "In 1953 there were approximately 7,450,000 businesses in the United States, of which only 441,767 were organized as corporations. Among these corporations 344,518 earned less than $250,000 and of these companies, 64,228 earned more than $25,000. As a matter of fairness and in the interests of strengthening the small business foundation of our economy, I do not see how we can justifiably provide tax relief for small corporations and do nothing for the millions of entrepreneurs who because of sound business reasons or statutory proscription are unable to avail themselves of the corporate form of organization."

Consequently, any such legislation as within the ambit of S. 352 would be helpful only as to a small segment of small business. While it is perfectly true that the 1954 Code provides a means whereby certain proprietorships and partnerships may elect to

(*Continued on page* 50)

# Quotes in Review

**a survey of major statements made during the past two months**

"Signal progress on both the military and civil fronts marked the activities of the aircraft industry during its fiscal year ending October 31, 1956. The industry not only substantially maintained its military production schedules, it simultaneously brought into service many manned aircraft and guided missiles of highly advanced capabilities.

* * * * *

"During the year, the Air Force accepted substantial quantities of 'century series' supersonic fighters and the Navy's air arm also took delivery of high-speed types. As a result, the three Marine air wings and the 17 Navy carrier air groups are now almost completely equipped with modern aircraft types. During the same period, the first heavy jet bomber wings were activated by the Air Force. The first of a series of fighters capable of flying twice the speed of sound took to the air. At the end of the fiscal year, America's first supersonic jet bomber was undergoing taxi tests preparatory to its maiden flight. And advanced production stages were attained on a fleet of jet tanker planes which will greatly improve the Air Force's long-range combat air capability.

* * * * *

"By July 1957, the minimum target strengths set for the air services several years ago will have been reached. These goals embrace 137 wings for the Air Force, 17 modern carrier air groups and proportionate strength for the Army and Marine Corps. They were devised on a timetable basis, as those military planners considered necessary, to assure the defensive and retaliatory capabilities required to discourage aggression against this country and her allies.

"To what extent these strength levels may be affected by changing degrees of world tension, or by the obvious progress of Soviet air power, is not known. As a result, it is currently impossible to determine what greater or lesser requirements may be made on the production capacity of the aircraft industry. Military planners will take periodic 'new looks' at the world situation and the aircraft industry will undertake whatever development and applied research and production activities the military services require as a result of these appraisals. It is certain, however, that there will be no compromise with quality in aeronautical products. The industry will be expected to develop and produce advanced weapons superior in all respects to those which can be developed and produced by potential enemies. It will be a continuing task to keep our military units supplied with such equipment."

***Admiral DeWitt C. Ramsey, USN (Ret)***
**The Board of Governors of the Aircraft Industries Association of America, Inc.**
**Washington, D. C.**

"I come tonight as a special pleader for military strength as a power for peace. Never was it so necessary to keep the peace. Never was it so vital to convince every other nation of the necessity to keep the peace. The world simply cannot yield to the temptation to war. War seems so attractive as the immediate solution for human wrongs. Preventive war appears to be an easy and direct course to rid the world of tyrannical dictators and to punish little pretenders. With all the tangential and centrifugal forces loose, we need a good, solid force that will hold the world constantly and unwaveringly on the beam toward peace.

* * * * *

"The fundamental aim of American military forces is to support our foreign policy, of which they are an inseparable instrumentality. Our Armed Forces are not only the reliable guardians of our freedom and national integrity—they are also the most dependable pillars of our diplomacy for peace. Foresight, imagination, and a bold and realistic approach to the problems of defense in the atomic age have characterized the development of our military program. It is wisely designed to provide the required strength without jeopardizing the basic freedoms of our people or the vigor of our economy.

"The team principle is fundamental to all our military efforts. Our interdependent Army, Navy, and Air Force work together to maintain the three-dimensional power necessary to deal with any enemy on land, at sea, or in the air. Each member has a unique and essential role. Each complements and supplements the others. Our military policy is not shackled to a single concept of war, nor is it based upon any one weapon or family of weapons. A resourceful enemy could be expected to strike at our weakest point. Hence we are not allowing ourselves to be weak or vulnerable in any particular. Our defense team is so constituted that it is ready for whatever emergency might develop during these critical times—whether it be a global war, a local or limited war, or any other form of aggression. It is capable of applying military power with proper discrimination to meet every situation with maximum effectiveness. Our Nation's powerful, balanced forces include every essential element of defensive and offensive strength. As a team, they have the ability to fight successfully against any enemy, any time, any place, and under any circumstances, which is the only effective deterrent to an aggressor."

***Wilber M. Brucker***
**Secretary of the Army**
**Illinois Manufacturers' Association**
**Chicago, Illinois**

"The electron may well be one of the keys that will help to unlock the door to Canada's future greatness. In many ways, it provides the answer to the problems raised by your geography, climate and population resources. Automation, for example, will come into increasing use as the means of assuring greater productivity in the face of a relatively limited working force. Together with industrial television, it will enable operations to be seen and controlled in places where climate, distance or the nature of the process limit human intervention.

"Mass production assembly, smelting, oil refining, equipment and product inspection—virtually any major industrial process—will employ these new electronic

methods and machines for control, regulation and production. This in turn will create new industries and services—new forms of employment and higher standards of living.

* * * * *

"We see electronics at work in almost every aspect of Canada's cultural life and national development. Electronic minds and hands are at work in factories. Microwave and other forms of communication link mining communities and logging camps. Electronic equipment sails with the fishing fleets off the Grand Banks, in the Pacific, on the Great Lakes and in Arctic waters. Radar and other electronic gear stand endless watch as northern sentinels of defense.

* * * * *

"I would leave you the thought that electronics will provide both our countries with the means for enriching our common destinies. It will provide new fields of employment for our people and new dimensions in entertainment. The new wonders of communication will expand our horizons while electronics further strengthens our mutual ramparts of national defense and peace."

***Mr. Frank M. Folsom***
**Chairman of the Executive Committee**
**Radio Corporation of America**
**The Canadian Club of Toronto**

"Along with other institutions of science and engineering, our salary problem is exceptionally acute. The shortage of scientists and engineers has pushed up the salaries offered by industry and Government, with the result that the gap between academic salaries in these fields and salaries in industry is widening. It is a shocking fact that young men receiving their doctor's degrees in science and engineering frequently now obtain jobs paying higher salaries than we can pay the teachers who directed their graduate training. Widening, too, is the gap between salaries paid by educational institutions and salaries paid by many non-educational but non-profit institutions and organizations. Certain of the foundations, research institutes, quasi- government organizations, and other institutions especially in the field of research have salary scales substantially higher than our academic salaries at M.I.T. It is not that their salaries are too high; ours are too low.

"As a result we are squarely up against the possibility that the best minds in our engineering colleges—and to some extent in our science schools—may be attracted away from teaching into industry or other fields. This possibility is further increased by the strenuous efforts now being made to recruit scientists and engineers for urgent defense projects requiring many hundreds of professional workers.

* * * * *

"If we permit this kind of deterioration to continue, the baneful effects for industry, for national security, and for the public welfare can become profoundly dangerous. Already we are engaged in an all-out technological race with the Russians. Already the Russians are training more scientists and engineers than the United States. Already they are offering greater incentives, rewards, and status to their scientists and engineers in education than are we. Already we have before the Nation a desperate need to augment the quality and quantity of scientists and engineers."

***James R. Killian, Jr.***
**President, Massachusetts Institute of Technology**
**Report of the President**
**Cambridge, Massachusetts**

"In simplest terms, the weapons systems philosophy means that, when the Department of Defense buys a new weapon today, it makes a serious effort to buy a 'complete weapon.' In the strictest sense, it attempts to place with one manufacturer the responsibility for providing an entire aircraft, or missile system, ready for operational use. This whole package is supposed to become an integrated and compatible system made up of major components and sub-systems . . . airframe, engine, fire-control equipment, air and ground instrumentation, test and maintenance gear, and so on. The company which wins a weapon system contract today thereby manages a complete and often complex program and, therefore, bears an important part of the responsibility for its success or failure.

"It is only in recent years that this concept has been widely dramatized and, even more recently, more widely adopted. Despite its dramatization, its emergence as an important aspect of modern-day military procurement has been more evolutionary than revolutionary.

* * * * *

"For example, in the development of bombing aircraft, there came a growing appreciation of the fact that there was an important relationship between the bombsight or bombing system and the navigation and steering system. In short, for most efficient bombing, there should be an integration or marriage of the bombing and the flight control equipment.

". . . you can still find instances where the procurement plan does not call for a real marriage in the design, development, and production of such major sub-systems as the bombing equipment and the automatic flight control equipment. Thus, despite the dramatization of the weapons systems philosophy, some of the weapons of the next decade will be assembled from bits and pieces, just as were the weapons of a decade ago."

***Dr. Carl A. Frische***
**Vice President for Operations**
**Sperry Gyroscope Company**
**Air Force Association**
**Garden City, New York**

"Industry naturally reacts unfavorably to being a special target, and the attitudes which special attacks reflect cannot help but retard progress, whether they are applied at local, state, or national levels. They will slow down the rate of expansion and growth and, in so doing, militate against the interests of the country and each of its subdivisions everywhere.

". . . I am afraid that we have developed a feeling in recent years that progress is somehow automatic—that success comes along as a matter of course. We have reached a stage in which nearly everyone can go to college, and each year we see frantic bidding for our new graduates. I sometimes think that many of them must have a distorted picture of the requirements for success in any undertaking.

"The fact is that the rules of pioneering haven't changed and the rules of success haven't changed. The rewards and the gains will go only to those who are willing to work hard for them."

***Henry B. du Pont***
**Vice President, E. I. du Pont de Nemours & Company**
**The Rotary Club**
**Louisville, Kentucky**

# The Civil War and the U.S. Military Telegraph Service

by Colonel H. V. Canan, USA (Ret.)

THE ADVENT OF THE CIVIL WAR FOUND THE TELEGRAPH a new but rapidly expanding industry. The people of the United States had been quick to realize its commercial and social advantages, and by 1861 telegraph lines girded the Nation and extended even to the west coast. The telegraph had become a major factor in the rapid exchange of news, information, and ideas.

Although its potential in warfare and in the dissemination of intelligence had been generally realized by military students, the telegraph was not an active tool of the U. S. Army. Little thought had been given to its use in combat and no plans existed to utilize commercial lines in the event of an emergency.

At the outbreak of war, all the telegraph facilities of both the North and South were in the hands of private individuals. In April 1861, with full cooperation of the telegraph companies of the North, the Government assumed nominal control of all telegraph lines leading into the Capitol. Assistant Secretary of War, Thomas A. Scott, secured the cooperation of Edward S. Sanford, President of the American Telegraph Company, who was most helpful in organizing a small unit in the War Department to carry on the operation, control, and supervision of the lines. For the first several months of the war, the small organization formed by Sanford was the only governmental effort to control the telegraph or to exploit its military possibilities.

### *Government Authority Limited Before Bull Run*

Until the Battle of Bull Run, the authority which had been imposed by the Government over private lines had been limited and of small consequence. It had been assumed that when need arose, private companies would extend their lines into the combat zones of the armies. It was a false premise and during the battle there was a lack of communication on the battle field.

Messages to Washington were just as bad, with half wire and half courier service forming the link between Maj. Gen. McDowell's army and the War Department. Even communication with nearby Harper's Ferry was broken. The independent force there under Maj. Gen. Patterson did not learn of the Union defeat for three days and then from a Philadelphia newspaper. This battle forced the Government to realize that its communication with the major portions of its army was deficient.

The little that had been accomplished toward the control and supervision of the telegraph in the early days of the war was achieved by the patriotic efforts of Sanford and the generosity of his company. The American Telegraph Company had made most of the expenditures in the early days of battle and had built, operated, and maintained telegraph lines which during a war should properly have been handled by a governmental agency.

Andrew Carnegie had been appointed by Scott as his assistant and soon he became the Secretary of War's right-hand man. When the Government finally realized the need for better military communications, Carnegie secured men of exceptional administrative ability for an expanded United States Military Telegraph Service. The initial appointment of only men from the telegraph industry soon led to its executives dominating the thought in the War Department.

### *U. S. Military Telegraph Service is Born*

Among those appointed in 1861 was Anson Stager, General Superintendent of the Western Union Telegraph Company. He was selected as chief of the newly conceived Military Telegraph Service. He submitted a plan for a unified service for the Army with lines going down to the headquarters of every major independent command. He recommended that a bureau which would purchase and distribute all materials needed for the construction and operation of the military telegraph lines be organized directly under the Secretary of War. Arrangements would be made with private companies for the use of their lines where needed. Stager's plan was approved and the Military Telegraph Service formally came into being as a civilian bureau, attached to the Quartermaster Corps. The civilian operators were given the status of Quartermaster civilian employees. Only a favored few were given commissions and considerable bad feeling developed among the majority of the men who remained civilians. Those in the field, many of whom received wounds in the war, repeatedly petitioned for military status. However, military status would have put them under the command of the military leaders, which Stanton and Stager wished to avoid.

### *Control and Growth of the Telegraph*

An act of Congress, passed January 31, 1862, gave the President authority to take over any or all telegraph and rail lines when the public safety so required and to operate them in the interests of national defense. The act allowed full development of the Military Telegraph Service. In February, Stanton as Secretary of War issued an order by which the Army took control of all telegraph lines. Censorship was provided.

Where leaks of information were suspected, the War Department did not hesitate to tap friendly wires. Specifications were placed on the use of codes and ciphers, leaving commanders entirely at the mercy of the civilian operators. This affected military operations, since the use of code rendered rapid communication in the field impossible. So that the Secretary of War would know

what was going on, copies of all messages sent in cipher were sent to Washington. Many Northern commanders felt that their acts and even their thoughts were under constant surveillance, that reprisal would follow if the Secretary of War did not approve. Lest their actions or statements be misinterpreted, they dared not reveal too much in their messages.

In spite of bureaucratic meddling, extension of the service followed rapidly. Each military department soon had its military telegraph chief. By the end of fiscal year 1862, there was a total of 3571 miles in the system. In fiscal year 1863, the annual construction had reached 3240 miles with 8340 miles in operation.

In the West the Military Telegraph was indispensable. The telegraph was needed on the long lines of communication. Although the wire was frequently strung along the railroads, line repair was fraught with danger. One out of every twelve men engaged in the work was either killed or wounded, or died of exposure.

Since the operations were farther from headquarters, matters did not go as smoothly in the West, at first, as they had in the East. Early in 1862, dispatches were not reaching Grant. Although they were sent to the end of the advanced wire, the operator failed to forward them. The operator soon deserted his post and went into the Southern lines taking all of the dispatches with him.

The most efficient service was in the East. An average of 200 miles of field wire was put up and taken down each day during Grant's Virginia campaign. As Southern territory was occupied, the lines captured were operated by the Military Telegraph Service.

As time went on, the need for field telegraph became more apparent. After McClellan took command of the armies, he cooperated with Major Myer, the Chief Signal Officer, in establishing direct field telegraph service to the troops on the battlefield.

### *Telegraph Equipment in the Field*

The first field train for the telegraph was purchased and sent forward for the Peninsula campaign in May, 1862. In addition to carrying flags, night signals, and rockets, light wagons carried ten miles of telegraph wire.

Myer's Field Telegraph became a most useful tool for commanders. From the modest beginning in the Peninsula Campaign, a total of thirty trains were procured and issued to the various armies of the North.

At the front, the Military Telegraph carried communications to army headquarters and the field wire carried them from there to corps headquarters and at times to lower echelons. The normal distance covered by the field lines during a campaign was from five to eight miles, although distances as great as twenty miles were reported. The equipment was excellent and improvement was made as needed. Wagons in the trains carried reels of five to ten miles of insulated wire—insulated so that it would transmit in storm, on the ground, or under water, even when not properly laid. The installation and repair were frequently carried out under small arms fire or artillery fire.

As each army moved forward, its field wire was taken up, but communication with the War Department was maintained by the more permanent installation of the galvanized wire of the Military Telegraph Service. A French military observer, though he acknowledged that field wire was a great advantage to commanders, feared that it would keep them too close to their headquarters where messages could never replace personal observation.

The Northern soldiers knew little about the field telegraph. Until warned by orders, they thought that the field wire was a part of a Confederate infernal war machine and soldiers would cut it for souvenirs. To prevent intentional or accidental interruptions of the wire during the battle at Fredericksburg, a detail of cavalry patrolled the line. Many of the patrol were stragglers who had found a job they could do which was removed from immediate rifle or artillery fire.

Although the Army had been successful in obtaining, operating, and improving the Field Telegraph, its successful operation had long been a cause for controversy. Civilian companies did not approve of telegraph operation by the military. The civilians in the Military Telegraph Service also expressed some dissatisfaction, although they worked harmoniously with the military in the field. Stanton wanted to extend his control to include the field lines.

### *Military Telegraph Service Takes Over*

The Field Telegraph Service was kept constantly on the defensive. Protests against the cabal undermining it were unfruitful. In 1863, Myer issued an unpolitic circular denouncing the systematic attempts of the civilian organization to deprive the Signal Corps of its field lines. Consequently, Myer was relieved from his duties as Chief Signal Officer, and the field trains were ordered turned over to the Military Telegraph Service. The military operators were ordered assigned to other military duty with the army. This crippled the Signal Corps and it scarcely could continue to carry out its functions.

Slowly the Military Telegraph Service assumed its new duties. In Virginia, in 1864 and 1865, Major Eckert, assistant general manager of the Service, and his civilian forces made decided efforts to provide Meade with ample telegraph facilities. Grant became enthusiastic over the services being rendered, both by his Signal Corps with aerial signals and by the Military Telegraph with the telegram. He described in detail how men of the telegraph service laid their lines without orders to the various lower headquarters, almost before the troops were in position.

There was no effective censorship of the telegraph during the first year of the war. It was a delicate matter and full of political dynamite. Since no one wanted to supervise censorship, it was transferred from department to department. It first appears to have been administered by the Treasury Department. Then the War Department took it over. The first real attempt at censorship seems to have been made by Lieut. Gen. Winfield Scott prior to the First Battle of Bull Run when, after a bad security leak, he ordered the telegraph companies to transmit no messages concerning military operations unless approved or authorized by him.

Censorship was next transferred to the State Department. The censor was instructed to put stringent rules into effect. These prohibited Washington from dispatching over the wires anything intended for publication which related to the civil or military operations of the government unless they were dispatches of the regular agent of the associated press. Nothing damaging to the

characters of military officers, the administration, or the cabinet could be sent over the wires from Washington.

These orders had little effect since no censorship of the mails had been attempted. There were no measures to prevent transmission of the prohibited news from telegraph offices in Baltimore, Philadelphia, New York, or other important cities. Many dispatches which were suppressed in Washington were mailed to other cities and put on the wires.

After the United States Military Telegraph Service was organized, the responsibility of telegraph censorship was returned to the War Department as a military function. From then on all telegraph communications not specifically authorized were forbidden.

As the use of the telegraph for military purposes increased, information gained from tapping telegraph wires became an important source of military intelligence for the South. Tapping was most productive during that period of the war when messages were sent in the clear. Wire tapping brought attention to the need for sending important messages in cipher.

An example of an early cipher is shown in a message sent by President Lincoln in 1862 to Burnside at Fredericksburg a few weeks before the battle. Lincoln requested a conference in a message which read as follows:

> If I should be in boat off Aquia Creek at dark tomorrow (Wednesday) evening could you, without inconvenience, meet me and pass an hour or so with me. A. Lincoln.

Suspecting that the Confederates had tapped the line, the Union operator used a homemade code in sending the message, depending upon the operator at the other end to figure out what was meant. The message read:

> Can Inn Ale me with 2 oar our Ann pass Ann me flesh ends N. W. Corn Inn out with U cud Inn heavenly day nest Wed roe Moore Tom darky hat Greek why Hawk of Abbott Inn B chewed if.

Lincoln's signature "Can Inn Ale" was at the beginning of the message and was, along with the balance of the message, to be read in reverse. The message was deciphered and the meeting arranged in spite of the risks involved.

As the war progressed, cryptography was developed. Commanders in the field had no access to the ciphers or keys. The cipher books were issued only to the "telegraphic experts," as approved and appointed by the Secretary of War. Commanders in the field were specifically forbidden to interfere with them. Since local military leaders had no command or control over the operators, the accuracy of the service rested with the operators alone.

Although the type of control and command used by the Military Telegraph Service was entirely foreign to the American concept of command, it worked. If we judge the Service by the results obtained, then it must have a high rating. One of the great feats of the war was the transfer of two corps of 23,000 men with impedimenta from the East some 1,200 miles to Chattanooga in eleven and one-half days. It was a remarkable rail movement, and without the closely knit, closely controlled, centralized telegraph, it could not have been accomplished.

After Grant took command of all the Union armies, he received by daily telegram all intelligence coming into the War Department. The efficient functioning of the Military Telegraph permitted him to be the first great military leader to use the telegraph for tactical and strategic planning.

Pictured here is the film for the Micro-Master camera. It is exposed in long rolls that are automatically transported as each frame is made from one magazine to another.

# PHOTOPROGRESS

by FRANK SMITH
Photo Editor, SIGNAL

## Kodak Sheet Film S. O. 1177

One of the most exciting bits of news which has been released recently is the announcement of the Eastman Kodak Co., Rochester, N. Y., regarding their new experimental super-speed pan sheet film designated as S. O. 1177 which is claimed by the manufacturer to be four times faster than Royal Pan.

The film has already been successfully pre-tested by a few metropolitan newspapers in recent weeks. Existing light photos heretofore regarded as impossible—night sports action photos, building interiors where shortest possible exposures are needed—have been handled successfully by press photographers using the new film.

S. O. 1177 is the result of recent discoveries made by Kodak scientists working in emulsion research. Because it has a very rich silver content, fixing time is longer than it is for other films. There is a slight, inherent fog in the emulsion but tests have shown that this does not interfere with good print quality. Grain is somewhat coarser than in Royal Pan, but it is finer than would be expected for such a large speed increase. Five to six times enlargements have proven very satisfactory for press work. Because the film is still in the experimental stage, it will only be manufactured in limited quantities so that improvements and modifications can be incorporated quickly.

The company recommends development in DK-60a for 6 to 10 minutes at 68 degrees F. or in DK-50 for 8 to 12 minutes at 68 degrees F. The longer development timer gives approximately 4 times the speed of Royal Pan. Further increases in developing time tend to increase contrast and fog without any appreciable further increase in speed.

Fresh developers should be used as partially exhausted developers may produce dichroic fog. This can usually be swabbed off while the film is still wet. Kodak rapid fixer should be used. Fixing time is slower than other films because of the richer silver content. Regular procedure may be used in washing.

The film is available only in three sizes (4″x5″, 5″x7″, and 8″x10″) and only in 25 sheet packages. Prices are the same as those for Kodak Infrared Film. Orders will be accepted only for one case or multiples and can be placed with regular Kodak dealers.

## New Projector for Data-Reduction Features Variable Speeds, Remote Control

Remote control of prolonged single-frame projection at full illumination is a feature of a new projector for critical analysis of 16 mm. motion picture films. Both forward and reverse projections in a range from 16 to 24 frames per second can also be controlled from a hand-held remote control box.

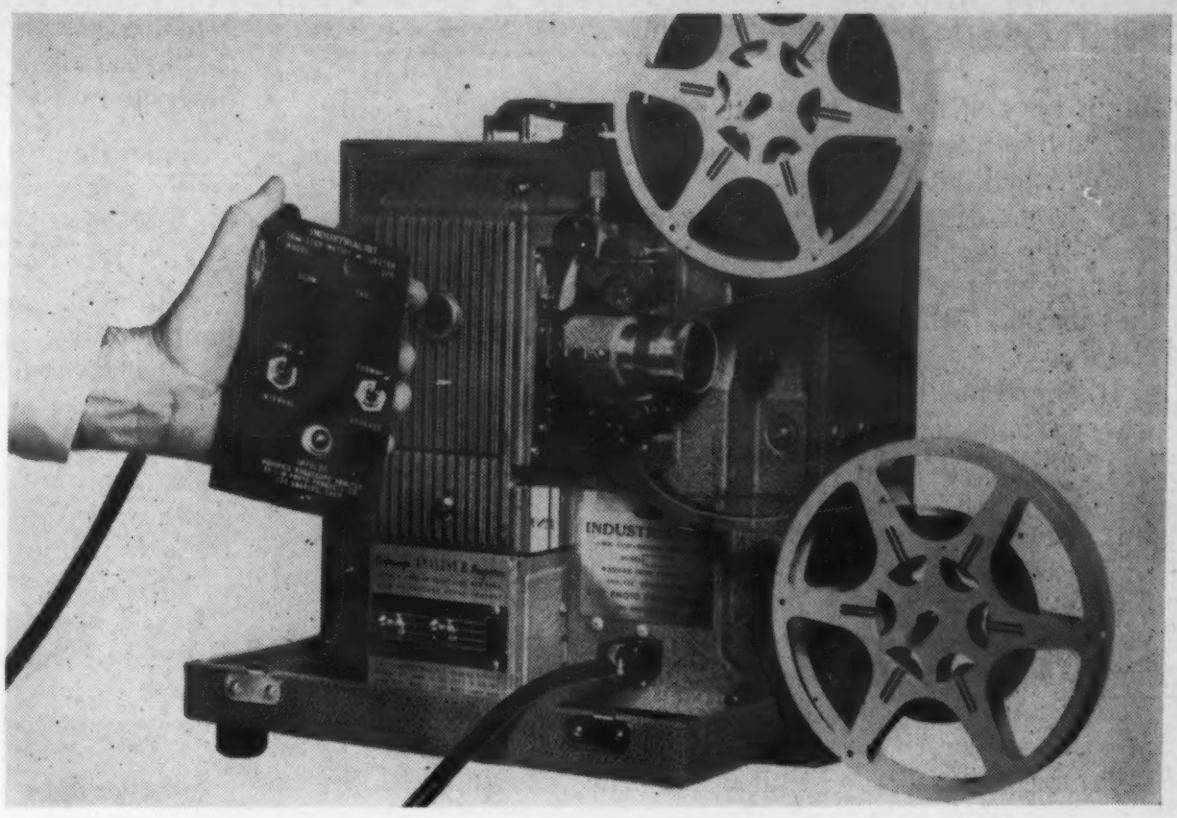
Called the L-W Industrialist, the new projector is a modification of an Eastman Kodak Kodascope 16 mm. silent analyst projector, combining the reliability and advanced engineering of the Kodascope projector with special adaptations required for data-reduction and methods analysis.

The L-W Industrialist can project a single still picture for prolonged study without the loss of illumination or the heat damage to film that has been a drawback in the past. The ability to advance or reverse by remote control one frame at a time or at speeds of from 6 to 24 frames per second permits slow speed frame-by-frame analysis of any portion of the film.

Advancing or reversing to a certain portion of the film is facilitated by the frame counter. A wide aperture plate will permit user to add identification marks onto the *sprocket* holes. A tilting design aids in proper alignment of the picture. The L-W Industrialist is completely portable; it operates in its case and only the cover need be removed. For daylight viewing in the analysts office, a Kodak Projection Viewer is built into the carrying case. This combines a special front surface mirror with a black day view screen. Film capacity is 400 ft., and cooling is provided by a constant speed motor for blower service. A fast power rewind is provided. The projector is manufactured by the L-W Photo Products Co., 817 South Flower St., Los Angeles 17, California.

## "Moonlet" Tracking Camera

One of the most interesting cameras to be announced recently is the "moonlet" (earth satellite) tracking camera which is being developed by the Perkin-Elmer Corp., Norwalk, Conn., for use in photographing the earth satellite which is scheduled to be launched during the coming International Geophysical Year, which starts July 1,



The L-W Industrialist 16mm motion picture projector. This features remote control and projection of a single still picture for prolonged study without the loss of illumination or heat damage to film. It has the ability to advance or reverse one frame at a time at speeds of from 6 to 24 frames per second permitting slow speed frame-by-frame analysis of any portion of the film.

1957 and runs through 1958. The camera, which will measure 10 feet high by 8 feet wide, has been designed and is being built under the auspices of the Smithsonian Institute.

According to Dr. Fred L. Whipple, Director of the Smithsonian Astrophysical Observatory which has been given the responsibility for the optical tracking of the satellite, scientists will require a precise determination of the satellite's orbit to achieve their planned experiments with the space ball.

Twelve of the special cameras, with one of the most difficult to produce optical systems ever attempted, will be produced and strategically placed about the globe to track the satellite.

They will be used for this purpose in conjunction with radio listening stations, astronomical observatories, and amateur observations (the latter called "operation moonwatch").

Two of the cameras are earmarked for use in the United States, one at White Sands Proving Grounds, New Mexico and the other at Patrick Air Force Base, Florida. The others will be placed at Arequipa, Peru; Cordoba, Argentina; Blomfontein, South Africa; Teheran, Iran; Cadiz, Spain; Hawaii; Japan; Australia; India; and an island in the Dutch West Indies.

Although the cameras are being built specifically for IGY studies, Dr. J. Allen Hynek of Ohio State University and Associate Director of the Satellite Tracking Program states that the telescopes are of highest optical quality and of sufficient versatility to be useful for a wide variety of future satellites.

The production of the optical systems for the cameras is being undertaken by the Perkin-Elmer Corp., builders of the Baker-Super-Schmidt Meteor Cameras and other optics for a number of astronomical observatories.

Dr. James G. Baker, President of Spica, Inc., and one of the foremost optical designers in the United States designed the 20 inch aperture, ultrafast f/10 apochromatic lens for the camera. The cameras have a 30 degree field of view.

The lens includes three aspheric corrector plates with a total of four aspheric surfaces, and a 32 inch mirror. The importance of aspheric surface to lens design is twofold. First, since an aspheric surface often replaces one or more classical surfaces, it means lighter weight and smaller lenses. Secondly, aspherics will sometimes correct aberrations not otherwise correctible, resulting in faster and more precise lens systems. The mechanical portion of the cameras was designed by Joseph Nunn and Associates of Los Angeles, Calif., and will be fabricated by Boller and Chivens of Pasadena, Calif. The lens system weighs 250 lbs. and will photograph the satellite on a strip of 55 mm. cinemascope film about one foot long.

### An Ultra-High Speed Lens for Use in Dim-light Photography and Television

Photographers and television cameramen requiring the utmost in light gathering power will be pleased with the announcement of the Farrand Optical Co., Inc., Bronx Blvd. and E. 238th St., New York 70, N. Y., who have announced availability of their new Super-Farron f/0.87 lens—an ultra-high speed photographic objective well-corrected over an unusually wide field. In contrast to other available lenses of similar aperture, the Super-Farron covers a much wider field (30 degrees) with a good correction that holds up over a broad spectrum.

In a 76 mm. focal length, the Super-Farron lens covers a 40 mm. diameter field, and is thus suitable as an objective for use with the Image Orthicon tube in television cameras and for 35 mm. photography.

In addition to the standard infinity correction for direct photography, the lens can be supplied corected for 16:1 magnification for fluoroscopic application and corrected for 4:1 magnification for photography of oscilloscopes for television, the lens can be supplied with correction for the envelope thickness of the pick-up tube.

Developed by an organization with an extensive record of achievement in optical design and manufacture as well as complete familiarity with end-use requirements, the design of this objective represents an important advance over previous developments in the field of ultra-high speed lenses.

### *L. J. M. Daguerre, The World's First Photographer*

This is the title of a beautiful and historically correct book on the history of photography by two well known historians of the subject, Helmut and Alison Gernsheim of England. Ordinarily books are reviewed in our book section, but this being such an exceptional volume and pertaining as it does to the history of photography, it

might be well to call your attention to it here by giving a thumbnail review.

Published late in 1956, the volume consists of some 216 pages of authentic photographic history (in this case, the daguerreotype), and 117 illustrations, one of them being no less than the first picture ever made in the world (1826), by Daguerre's partner, Nicephore Niepce.

Daguerre, as is generally known, is the French inventor who gave the world the first practical photographic process (1839). The book is an absorbing and intriguing study of Daguerre and his process and covers his life from the time he was apprenticed to an architect, through his work as a scene designer, inventor of the diorama and inventor of the daguerreotype.

The book successfully portrays the fascinating developments leading to the invention of the daguerreotype as well as a number of other items indirectly related to the process. The price of the book is $7.50 and it may be obtained in the United States from the World Publishing Co., New York City.

Anyone interested at all in the history of photography, and particularly the daguerreotype, will do well to add this volume to his library, and schedule it for an early and complete reading.

### New Wide-Film Microfilm System

An entirely new reproduction system on film that can both improve most worn and smudged drawings and produce sharp, clear, and distortion-free second originals up to 36x54 inches in size or even longer, was introduced recently by Keuffel and Esser Co., Hoboken, N. J.

The system, called Micro-master, was developed to satisfy exacting professional and archival standards by Micro-master, Inc., Kansas City, Mo., in association with Keuffel and Esser. Based on a 105 mm. negative that is 16 times larger in area than conventional 35 mm. microfilm, Micro-master is being offered as a nation-wide reproduction service.

An entirely new concept in reproduction, the new process provides a series of advantages for precise engineering and architectural work that make it superior to any existing method.

To begin with, Micro-master was not adapted from any existing process. Microfilm, by contrast, depends on 35 mm. or, in a few instances, 70 mm. motion picture stack and conventional single-frame cameras. Where larger cut film sizes have been used, only standard cameras, projectors, and processing techniques have been employed.

The 105 mm. negative size of Micro-master represents the smallest area possible for handling, storage, and shipping that is consistent with the ability to achieve full-scale reproductions without distortion and loss of detail. The negatives of 105 mm. size are small enough to fit into standard 5" x 8" filing drawers and a series of them occupies only about 1/25th of the space required for an equal member of tracing.

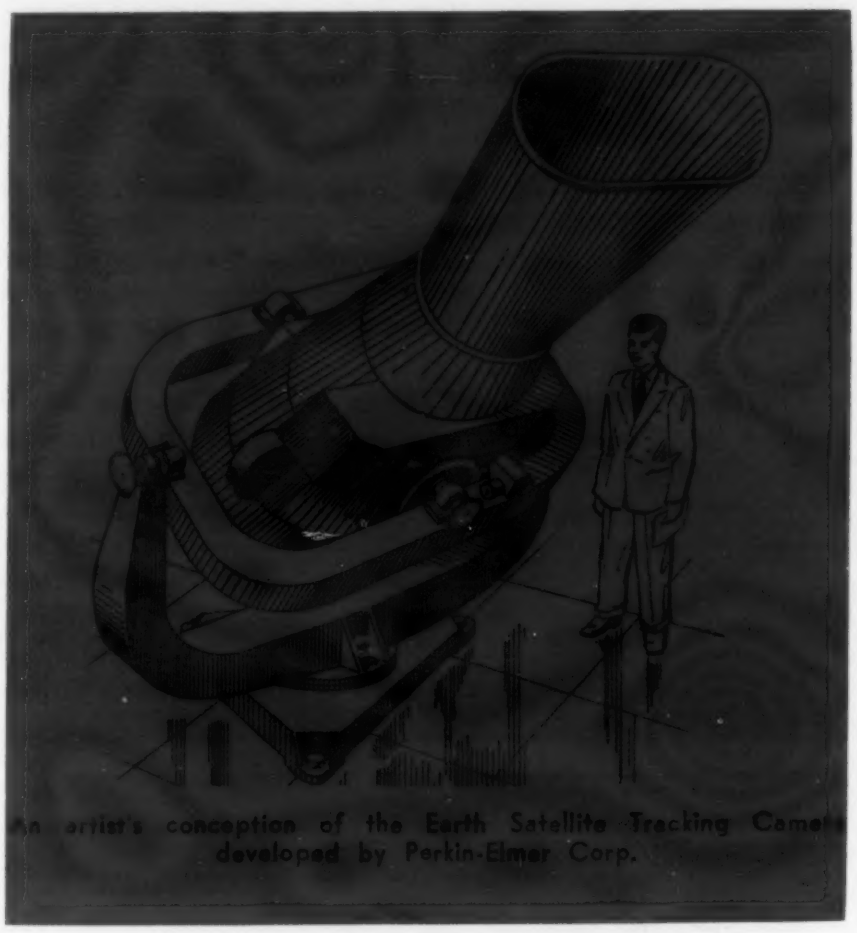
Roll film is used for loading in the camera and for development. After developing, each negative is cut apart and is ready for filing and reproducing. Micro-master is a complete system. Economical 4" x 6" card prints are available for filing and reference.

The line of equipment includes fully-engineered screen projectors, table-top viewers with an 8" x 12" surface, and large-sized viewing tables for drafting room use.

### Mullard Image Dissector Tubes for Recording A Series of Photographic Frames in Sub-Microsecond Periods

Some interesting news has emanated from England recently concerning the Image Dissector Tubes (available on special order only), of Mullard, Ltd., Mullard House, Torrington Place, London, W.C.I.

Although image converter tubes used as electronic shutters have given satisfactory single exposures as short as $10^{-9}$ second, the most efficient fluorescent screens have an afterglow of $2 \times 10^{-5}$ second, which limits the repetition rate for multiple shots and causes blurring if high speed film transport is used. To make possible the recording of up to 100 frames on a single negative, image dissector tubes have been developed. The photo-cathode of an image dissector tube is active only in an array of "mark" areas separted by non-emitting spaces, so that with uniform illumination on the cathode only the "mark" areas are reproduced on the fluorescent screen. During an exposure, electromagnetic or electrostatic scanning deflects the "marks" uniformly across the "spaces"



An artist's conception of the Earth Satellite Tracking Camera developed by Perkin-Elmer Corp.

at the screen, the tube being switched off before overlapping occurs. The result is a composite negative which can be analyzed into a series of frames each representing a single time element. The analysis can be effected either by viewing through a suitable transparency or by "playing back" through a decoding tube. One type dissector tube is the "dot cathode" tube. The cathode is active in an array of dots 0.001 inch square and 0.009 inch apart.

Scanning is effected electromagnetically. A decoding tube for a different type of image dissector picture has also been developed. The cathode of the image tube is sensitive in a series of concentric rings separated by negative spaces. Scanning is effected electrostatically by varying the anode voltage. The decoding tube is similar in principle and by varying the applied voltages a particular frame can be picked out of the composite picture.

Full technical information concerning these tubes may be obtained by writing the manufacturer at the address shown above.

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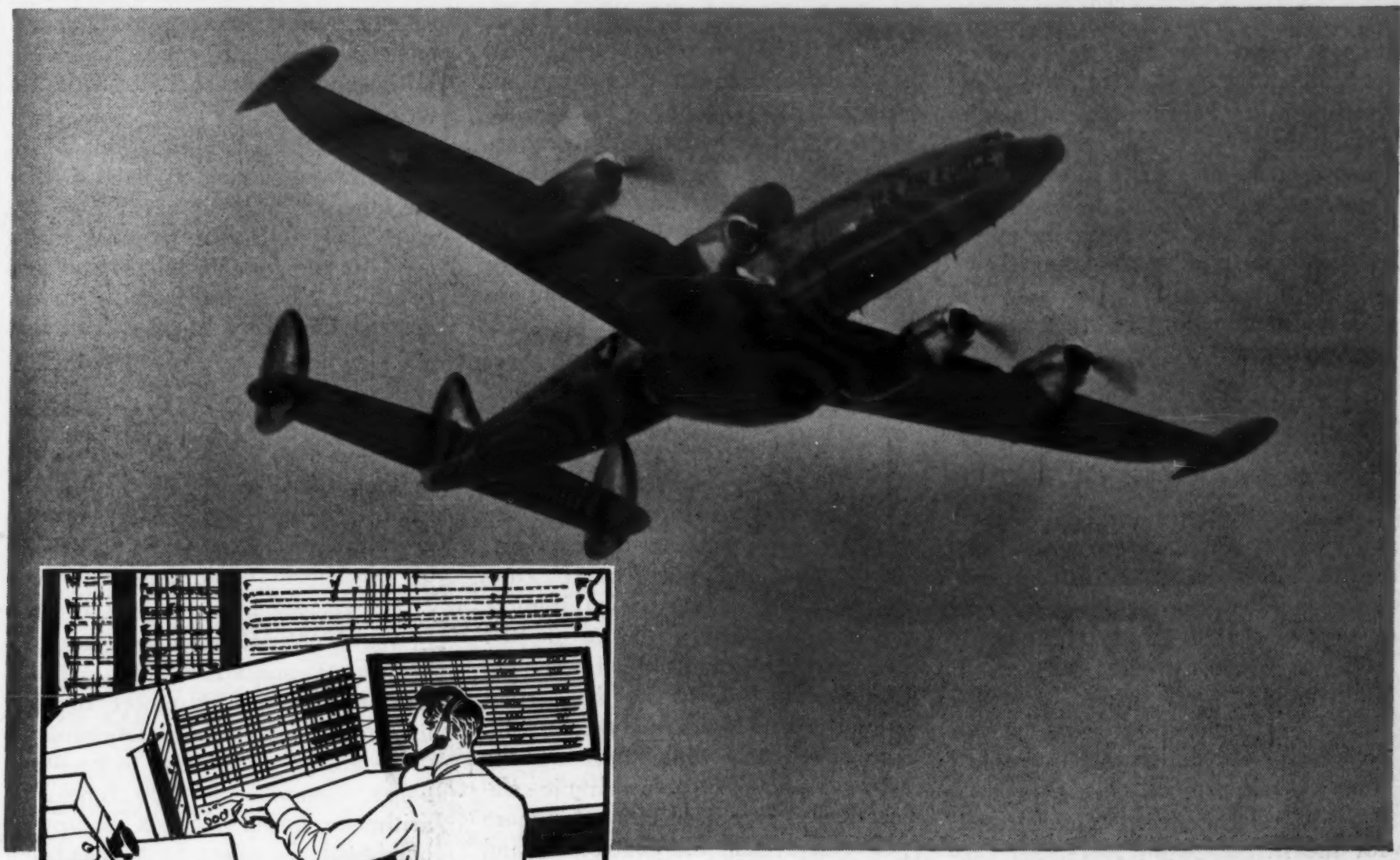



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MANUFACTURING AND SUPPLY UNIT OF THE BELL SYSTEM

## A Tax Bill of Interest

(*Continued from page 40*)

be taxed as corporations, [Sec. 1361, 1954 Int. Rev. Code] it must be realized that this right does not apply to all sole proprietorships or partnerships as such. Further, an election to be so taxed when circumstances permit is, with one narrow exception, irrevocable and binding as to future years.

Aiding as it would some 98% of corporate taxpayers, the smaller ones, this bill would lay the foundation for drawing a line between big and small corporations with the result that there would be disparity in tax treatment between corporations based on size, as well as disparity between small businesses depending upon their form of doing business.

The introduction of this novel principle of the graduated tax in the corporate area is therefore not without concern. While the proposed rates equate fairly well with present procedures, it seems perfectly obvious that if this principle becomes law, the rates will be altered as to corporate taxpayers in much the same fashion as has been true with individual taxpayers. In accord with the theory that taxes should be imposed on the basis of the ability to pay, large corporations will find, particularly in times of emergency, that the rates will be on the ascending scale. The pattern has been set as to the taxation of individuals; it will not deviate if the taxpayer is a corporation. Since there is a tendency (if not a practice) where graduated taxes are used to impose the greatest burden on the "big" taxpayer, this may well become the pattern for the so-called "big" corporation. With this thought in mind, the plight of a corporate stockholder whose dividend comes after taxes is awesome to contemplate. It is to be hoped that if this new principle comes to pass there will be some provision for the deductibility of dividends in the computation of corporate taxes. Without such a provision, raising funds for capital improvement by means of equity financing would be severely prejudiced, if not terminated.

Despite the good intentions of S. 352, it would seem on balance that the inherent disadvantages which are most likely to accrue from its enactment outweigh the immediate and relatively short-run benefits to be derived therefrom. - - - — - —

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## A Progress Report on SEAC

(*Continued from page 25*)

In the trial demonstrations, an average of two seconds was required for each patent search. However, the present tape units on SEAC are soon to be replaced by eight high-speed multichannel units which are expected to increase the search speed by a factor of 8 for further investigations by this project.

SEAC's latest feat, demonstrated for the first time on November 30, 1956, was accomplished by attaching a facsimile digitalizer as one of the selected input-output units. It then scanned a visual configuration (initially a black letter on a white background) and reproduced the pattern of black and white as ones and zeros in the memory. Then machine programs were fed into SEAC which analyzed the pattern in several ways: (1) to determine the relative proportion of black to white; (2) to identify the number of discrete black areas in the viewing field; (3) to obtain statistical data on areas in the field that are always covered or always not covered by a specified shape that is moved about rectilinearly; and (4) to test particular character recognition logic.

The present work of the data processing systems laboratory is, in many respects, an outgrowth of the pioneering efforts of the personnel of the electronic computers laboratory and the applied mathematics division, who were responsible for the design, development, expansion, maintenance and use of SEAC. During its lifetime, the basic circuitry has been improved and incorporated in a package design which provided the building blocks of the second computer constructed by the Bureau. The DYSEAC, while utilizing the same basic electronic circuit elements, was organized into a far more powerful system for controlling and responding to auxiliary external devices. Major emphasis was given to versatility of control facilities and latitude for expansion. The entire installation was eventually housed in two 40-foot trailer vans and transported to White Sands, New Mexico, for ultimate use by the Signal Corps.

### *Impetus to Research Programs*

Closely allied with, and basic to, the development of the systems specifications, are the research in and development of new components, techniques and improved circuitry. A continuing investigative program in semiconductor devices and their properties has led to the development of the diode capacitor memory, the diode amplifier, and gas diode indicator and display devices. For several years NBS actively participated in a program of cathode-ray tube improvement for computer storage (memory) application. Research in the utilization of magnetic materials as computer memory elements is in progress, as well as the design of experimental transistor circuitry.

The success of packaged circuitry in the DYSEAC gave impetus to a project to miniaturize the package and thus, reduce its power requirements and size while maintaining its drive ability. This may make possible a computer of 100 times the arithmetic power of SEAC occupying one-fourth the space. SEAC has been, and is continuing to be, used as the proving ground of model designs of such developments as the diode-capacitor memory, an improved Williams memory, diode amplifier applications, packaged circuitry, and other work of the laboratories.

A natural corollary activity of the Bureau, in addition to the many consulting and advisory services to the Government activities, has been the dissemination and exchange of information with representatives of the scientific laboratories and industrial concerns of the United States and abroad. Especially now with the popular emphasis on automation and its possible effects on the standard of living and economy, the number of activities interested in keeping abreast of the progress of automatic data processing and control has greatly increased the scope of consulting and advisory services.

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# Association Affairs



## Award Made to the AFCEA

An award of the "Lee De Forest Commemorative Plaque" was made to the Armed Forces Communications and Electronics Association by the Veteran Wireless Operators Association, (VWOA).

The presentation of the plaque was made on the occasion of the Thirty-Second Anniversary Dinner-Cruise of the VWOA. Former AFCEA National President George Bailey represented President Percy Black at the Sheraton-Astor Hotel in New York City on February 21st to accept the award.

Further coverage of this event will be featured in the April issue of SIGNAL.

## Honor Graduates Receive Awards

The Armed Forces Communications and Electronics Association Award for outstanding scholastic achievement was recently presented to honor graduates at the Signal School, Fort Monmouth, N. J.

Five of the officers were enrolled in the Signal Officers Basic Course which is designed to give a working knowledge of the duties and responsibilities which the officers may expect during their early service with the Signal Corps.

Highest percentiles in the basic course were held by the following:

Section 712 — Second Lieutenant James B. Calvert, 1210 N. 30th St., Billings, Mont. He attended Montana State College.

Section 713—Second Lieutenant Kenneth F. Gordon, 8 Park Place, Holley, N. Y., who graduated from Cornell University.

Section 714—Second Lieutenant George P. Lang, 2214 Hess Ave., Wheeling, West Va. He is a graduate of Carnegie Institute of Technology.

Section 715—Second Lieutenant Frank G. Selleck, 679 Ridge Road, Middletown, Conn., who studied at Rensselaer Polytechnic Institute.

Section 716—Second Lieutenant Richard L. Heckman, 9401 Manor Road, Kansas City, Mo. He is a graduate of Iowa State College.

In the Radar Maintenance and Repair Officer Course, high man was Second Lieutenant Paul D. Schoomaker of 4 Overlook Drive, Northboro, Mass. Lt. Schoomaker is a graduate of Worcester Polytechnic Institute.

Second Lieutenant Robert Miller took the number one spot in the Signal Materiel Maintenance Officer Course. Miller, a resident of Viborg, South Dakota, studied at South Dakota State College.

## General Larew Retires

Brigadier General Walter B. Larew, Chief of the Army Communications Service Division in the Chief Signal Office, retired recently after 31 years of Army service.

General Larew began his career in the Army Signal Corps in 1926. During World War II, he served in the China-Burma-India Theatre. Upon his return, he became Director of the Communications Department and Chief of the Communications Section at Orlando, Fla.

During the Korean Conflict, General Larew once more saw service as Signal Officer of the Ninth Corps and later Signal Officer of the Korean Communications Zone.

SIGNAL magazine has been honored by General Larew's many contributions and his continuing interest in the Armed Forces Communications and Electronics Association. Our best wishes go with him in retirement.

## Chapter of the Year Award

The 1956-57 "Chapter of the Year" will be named at the national convention at the Sheraton Park Hotel in Washington. The award, an engraved plaque, will be presented to the winning chapter during the annual banquet on May 21, 1957.

The award is based on chapter activity in the following categories during the fiscal year ending March 31, 1956: number of new members, percent of new members, percent of renewals, and number of monthly meetings. Points are awarded in each category as follows: first place—5 points; second place—4 points; third place—3 points; fourth place—2 points; and fifth place—1 point. The chapter earning the largest total of points in the four categories wins the award.

Chapters are reminded to forward to National Headquarters promptly any membership applications and renewals they have on hand, as well as reports of all meetings.

(*Continued on page* 52)

## Technical Papers Chosen

The chairman in charge of the committee for securing technical papers to be presented during the AFCEA National Convention, Mr. Francis H. Engel, has informed Convention chairman, Admiral Joseph R. Redman, of the following papers which have been selected for presentation:

"Rapid Fault Elimination in Complex Electronic Systems," Monroe Calculating Machine Co.; "Single Sideband Receivers," Radio Corporation of America; "Single Sideband Applied to Air-Ground Comunications," Collins Radio Co.; "A Single Sideband Radio Central to Replace Military Wire Lines," Motorola, Inc.; "The Trend of Facsimile in Military Communications," Times Facsimile Corp.; "Processing, Narrow-Band Transmission, and Remote Display of Radar Data," Lewyt Manufacturing Corp.; "Multiplexing Circuits in the National Air Defense Communications Networks," Lenkurt Electric Co.; "The Air Route Surveillance Radar for U.S.A. Air Traffic Control," Raytheon Manufacturing Co.; "The Vanguard Launching Vehicle Instrumentation System," The Martin Co.; "Results of a Simple Technique for Handling Complex Microwave Circuits," Sylvania Electric Products, Inc.; "A Fully Automatic Teletypewriter Distribution System," Automatic Electric Co.; "Some Aspects of Telegraphic Data Preparation and Transmission," Western Union Telegraph Co.

Time and space allocation alone directly affected the choice of additional papers. As this is the first time technical papers will be presented at an AFCEA Convention, National Headquarters wishes to express its profound thanks to the many contributors who responded to the Association's request for material.

## Colonel Farnham Retires

Lt. Col. Nell E. J. Farnham, active for many years in the launching of progress of Armed Forces Communications and Electronics Chapters, has recently retired.

Colonel Farnham has had 14 years of active duty and has formerly been attached to the Signal School at Fort Monmouth, N. J.

A charter member of AFCEA in 1946, she helped organize the European Chapter in Frankfort, Germany and the chapters at Fort Gordon, Ga., and Paris, France. She has just completed an active year as secretary of the Fort Monmouth chapter.

# AFCEA Group Members

## Communications—Electronics—Photography

***Listed below are the firms who are group members of the Armed Forces Communications and Electronics Association. By their membership they indicate their readiness for their share in industry's part in national security. Each firm nominates several of its key employees or officials for individual membership in AFCEA, thus forming a group of the highest trained men in the electronics and photographic fields, available for advice and assistance to the armed services on research, development, manufacturing, procurement, and operation.***

Admiral Corp.
Air Associates, Inc.
Aircraft Radio Corp.
Allied Control Co., Inc.
Allied Radio Corp.
American Cable & Radio Corp.
American Electronic Laboratories, Inc.
American Institute of Electrical Engineers
American Machine & Foundry Co.
American Radio Relay League
American Telephone & Telegraph Co.
American Telephone & Telegraph Co., Long Lines Dept.
Ampex Corp.
Amphenol Electronics Corp.
Anaconda Wire & Cable Co.
A. R. F. Products, Inc.
Argus Cameras, Inc.
Arnold Engineering Co.
Atlas Precision Products Co.
Automatic Electric Co.
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Dana, P. A., Inc.
Designers for Industry, Inc.
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Dukane Corp.
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Eastman Kodak Co.
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Prodelin Inc.
Radiart Corp.
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Westinghouse Electric Corp.
Weston Electrical Instrument Corp.
Wheelock Signals, Inc.
Wickes Engineering & Construction Co.
Wilcox Electric Co., Inc.
Willard Storage Battery Div., Electric Storage Battery Co.
Wisconsin Telephone Co.
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# Mark of a New and Deadly Guided Missile


"Sidewinder" is the Navy's newest air-to-air guided missile. Flight tests have proved the missile to be as vicious as the desert rattlesnake for which it was named.

In brilliant performances against airborne targets at China Lake, "Sidewinder", Navy's new air-to-air guided missile, has captured the attention of the entire missile industry.

Simple in operation, small and light enough to be carried in quantity by single-seat Interceptors, "Sidewinder" can be fired singly or in salvos. It requires no complex launching system or special pilot training, and it maneuvers deftly at supersonic speeds. The missile displays extremely high single-shot accuracy —and even more important, *it can be launched well beyond reach of the target aircraft's defense.*

"Sidewinder" was developed by the Naval Ordnance Test Station of the Navy Bureau of Ordnance at China Lake, California. Philco assisted NOTS in the research and development program, and performed the subsequent engineering required for manufacture of the missile. "Sidewinder" is *now in full production at the Philco Government and Industrial Division.*

Philco is proud to have made this important contribution to the development of more effective electronic systems for our national defense.

***Engineers: At Philco your opportunities in research and engineering are unlimited.***

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# Chapter News

**Atlanta**—Inspecting the high speed motion picture camera: from left to right, Mr. Ralph Grist, Mr. W. F. Johnson, Mr. B. S. Gilmer, President of Southern Bell Telephone Co., Mr. W. L. Porter, Mr. Arthur Reed, Colonel Don Adams, and Mr. C. M. Eberhart.

### *Atlanta*

The chapter's December meeting was highlighted by a program presented by representatives of the Eastman Kodak Company.

The guest speakers were Arthur J. Reed and W. L. Porter, Professional Technical Representatives, who demonstrated high speed motion picture photography and showed the film, "Magnifying Time," on the subject. They pointed out that there is a greatly expanded use of photography in industry, especially in public relations, advertising, sales, personnel, merchandising and safety.

In January, the chapter meeting was held at the Fort McPherson Officers' Club. An interesting program of entertainment was presented by the Special Services Section of the Third Army.

### *Augusta—Fort Gordon*

The chapter's December meeting was held in Augusta and featured an annual ladies night dinner-dance.

Installation of the new officers elected in November took place on this occasion.

### *Boston*

Mr. Thomas R. Hennessey, vice president, Public Relations of the New England Telephone and Telegraph Co., acted as host to the chapter at its January meeting in the telephone building at 185 Franklin Street in Boston.

Following dinner and a conducted tour of the building, the group assembled in the auditorium for a demonstration of Direct Distance Dialing by Mr. Francis J. Cronin. This was particularly timely as the service is coming to Boston and the adjacent areas in June of this year.

The final demonstration of the evening was made by Mr. Robert Maguire and consisted of a composite presentation of information collecting agencies which included picket planes, the DEW line system, and defense facilities such as intercepting planes and NIKE installations. This was the first public presentation of the demonstration which is known as the "Nation's Sentinel."

### *Fort Monmouth*

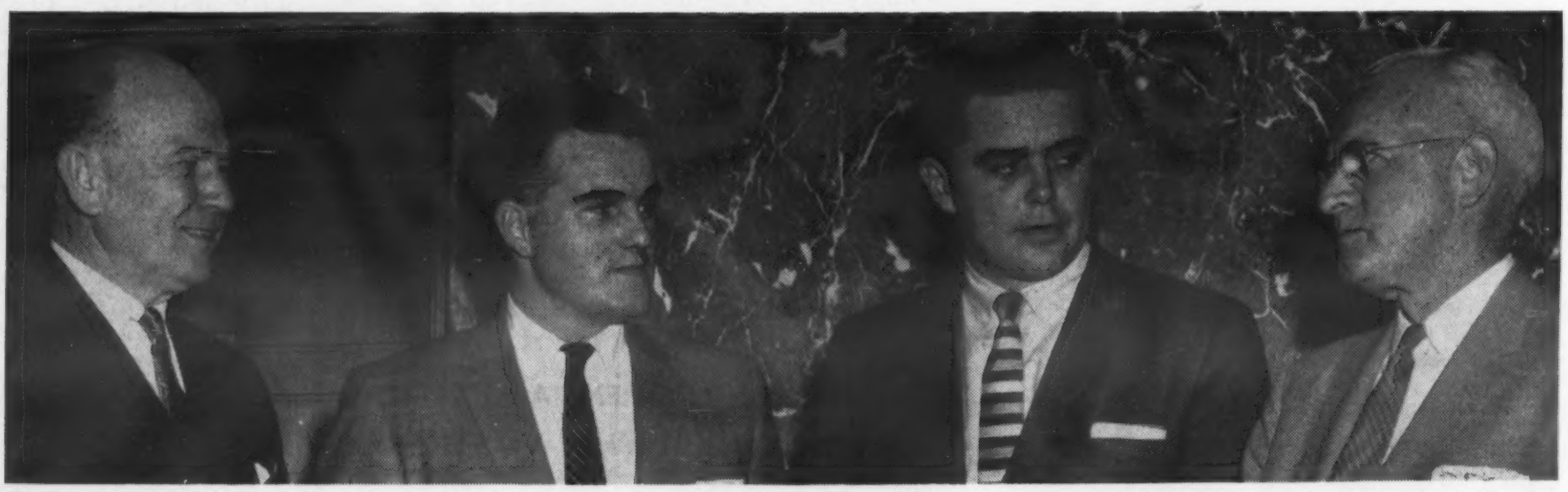
More than 200 members attended the January dinner-meeting of the chapter. The guest speaker was Mr. Jorgen Jensen, an expert on rocketry from the Glenn L. Martin Company, Baltimore. He chose as his subject, "Man-Made Earth Satellites" and gave an extremely interesting lecture.

The chapter wishes to announce that during 1957, meetings will be held the third Thursday of the month at Gibbs Hall Officers' Club.

### *Lexington*

In December the chapter sponsored an Industrial Mobilization Program. Chapter members and representatives of the Department of Commerce attended a joint dinner-meeting held at the Phoenix Hotel in Lexington.

William R. Haines, Director of Industrial Defense for the Business and Defense Services Administration, of the Department of Commerce, delivered an address on the "Posture of Readiness," for industry in the age of the H-bomb. He stated that in the defense of American industry, it is the Government's job to reliably estimate stock requirements and maintain procedures for the ade-



**Boston**—From left to right, Thomas R. Hennessey, vice president public relations, New England Tel. and Tel. Co.; Francis J. Cronin, public relations representative, New England Tel. and Tel. Co.; Mr. Robert Maguire, supervisory ass't, New England Tel. and Tel. Co.; and Mr. Fred E. Moran, president, Boston Chapter, AFCEA.


**Sacramento**—January dinner meeting of the AFCEA, Mr. M. G. Mauer turning over the Sacramento Chapter to the new president, Lt. Col. C. M. Godfrey.

quate stock-piling and efficient, prompt distribution of scarce and critical materials in the event of attack.

To insure the continuity of essential production, he told the group, every company should prepare an overall plan for industrial defense which encompasses the activities and responsibilities of every department from the plant level to top management.

Haines' speech was of such significance that it has been reprinted in its entirety in the January, 1957 issue of SIGNAL.

After the speech, time was given for general discussion with members and guests on "Methods and Plans for Programming for Industrial Mobilization."

### *New York*

The initial 1957 meeting of the chapter was held at the Belmont-Plaza Hotel in New York City on January 30th.

The meeting was preceded by a social hour and dinner. Announcement was made of the following Standing Committee Chairmen, as approved by the Board of Directors: Public Relations—Edwin C. Carlson; Financial—William L. Hallahan; Liaison—George W. Bailey; Membership—Glenn D. Montgomery.

Guest speaker of the evening was Mr. Seymour N. Seigal, Director of Communications for the City of New York. He addressed the meeting on the subject of "Communications for Civil Defense." He was assisted by Mr. Charles J. Hartley, Chief Supervisor of Civilian Defense Communications and Mr. Robert Link, Supervisor of Radio Amateurs Civilian Emergency Services. Mr. Seigal illustrated the overall Civilian Defense Communications Organization established for the City of New York by a number of charts and photographs. He pointed out that the maintenance of the water supply was one of the first essential requirements in an emergency, and that communication systems utilizing wire lines and radio for both voice and telegraph operations have been established for this purpose.

He further stated that most of the Civilian Defense Communications System requirements have been planned. The essential elements have been set up on a standby basis in co-operation with the New York Telephone Co. and the Western Union Telegraph Co.

He explained that plans also have been made to limit non-essential telephone calls in case of a civil defense emergency in order to prevent interference to emergency communications. Mr. Hartley outlined the important part played by microwave radio, VHF and HF radio in Civil Defense plans. The major broadcasting stations in the New York area can be tied together and controlled from one location whenever required.

Mr. Robert Link discussed the important part which the radio amateur plays in the Civilian Defense Communication picture. Many of them have volunteered their services and have also loaned or furnished radio equipments for the various control centers.

Major General Robert E. Condon, Director of Civil Defense for New York and members of his staff were present at the meeting.

### *Rocky Mountain*

The chapter's December meeting was held at Ent Air Force Base.

At that time the program consisted of dinner, a business meeting and the showing of two special interest films of Yuma, Arizona Air Force Base's annual rocketry meet.

### *Rome-Utica*

"New Developments in Surface Communication" was the presentation of Mr. I. R. Saddler, manager of materials and modules planning at RCA, Camden, N. J., to the Utica chapter members in January at Griffiss AFB Officers' Club.

The talk was illustrated with a color-sound motion picture that described RCA activities in the field of military communications. This film explained the various divisions of the company's defense products areas and things in development and production.

**South Texas**—January meeting—left to right: Ben Givens, San Antonio division manager, Southwestern Bell Tel. Co.; Col. A. H. Snider, USAF, Chapter President; Mr. J. M. Black, guest speaker and operating vice president of the Southwestern Bell Tel. Co., and Mr. R. A. Goodson, Texas general manager, Southwestern Bell Tel. Co.

Following this, Saddler demonstrated an ultra-miniature radio transceiver, a device about the size of two king-size packs of cigarettes which has a communications range of about a mile or two. He also demonstrated a self-powered maintenance inter-phone for use by maintenance crews and an ear protector that is worn by ground crews when operating in the vicinity of high ambient noises.

Prior to the technical meeting, a social hour was held.

### San Francisco

The following slate of officers was chosen at the chapter's last meeting: president—Lt. Comdr. S. N. Barton, USNR, Mackay Radio; vice presidents —Maj. T. D. Razovich, USAR, Radio Station KFRC; R. A. Krause, Stanford Research Institute; K. W. Goossens, Pacific Tel. & Tel. Co.; secretary—Col. H. L. Schnoor, USAR, Pacific Tel. & Tel. Co.; treasurer—Lt. Col. W. G. Damerow, USAR, Pacific Gas and Electric Co.; directors — Col. S. S. Cerwin, USA. Sig. O. Hq. 6th Army; R. H. Cobb, Western Union Tel. Co.; W. B. Nielson, Lenkurt Electric Co.; F. V. Sloan, Federal Communications Commission; Col. L. C. Parsons, USA Ret.; W. R. Patton, Sylvania Electronic Defense Lab.

Following the election, Mr. C. L. Wickstrom, past president, expressed his feeling for the good work which had been done by the chapter and thanked everyone for the cooperation received during his past two year term. Lt. Comdr. Barton, the incoming president, thanked the group for the trust placed in him and promised his full support behind the aims and objectives of the Association.

Talks by Col. Cerwin, Capt. Patterson and Cmdr. Anthony on the subject of "Modern Communications in the Armed Services" ended a very successful evening.

### Scott-St. Louis

Col. Charles W. Gordon, commander of the 3310th Technical Training Group, was the speaker at the January meeting of the Scott-St. Louis area chapter in Belleville, Illinois.

In introducing a new USAF film which he presented after his talk, Col. Gordon related some interesting engineering problems which he had encountered in his past experiences in the communications and electronics field. He emphasized the importance of the support given by the engineers who construct the specialized buildings and structures necessary to accommodate electronics installations.

The film which Col. Gordon presented is a new 30 minute USAF color film entitled "Air Force Engineers." It depicts the various activities of Air Installations engineering in the operation of Air Force Bases and some of the unusual problems which have been met by Air Force engineers. A highlight was the description of Thule Air Force Base in Greenland which is constructed entirely on perma-frost. Buildings have to be insulated from beneath lest they melt themselves into a hole.

Other features were pictures of the world's largest airplane hangar, underground fuel storage systems, the climatic test hangar in Florida, and how Air Force bases are planned and kept up to date.

**Northeastern University**—AFCEA cameramen shout commands on the parade grounds during the filming of the Northeastern University Fall Awards Parade at Boston, Mass.

### South Carolina

The chapter held a two day session for its last meeting. A dinner was given at the Charleston Officers' Club on January 11th. Distinguished guests included Rear Admiral H. C. Bruton, Director of Naval Communications, Washington, D. C.; Captain C. C. Burlingame, Commanding Officer, U.S. Naval Minecraft Base; Mr. Ralph S. Grist, Southern Bell retired and Regional Vice President AFCEA, Atlanta, Ga.; and Mr. J. C. Baughman, Southern Bell General Coordinator of Military Services, Atlanta, Ga.

Following dinner, Mr. Grist gave a brief talk on AFCEA aims and purposes. Admiral Bruton, the principal speaker of the evening, was introduced and gave a very interesting talk on "Recent Developments in Naval Communications - Electronics" which has been printed in this issue on page 7. This topic was supplemented by the

**San Francisco Chapter**—Annual meeting for the election of officers was held on January 17, 1957. Pictured above from left to right are: first row, J. F. Parachini, director; S. N. Barton, president; Major T. D. Razovich, a vice president; Lt. Colonel W. G. Damerow, historian; second row, H. L. Schnoor, treasurer; H. W. Austin, director; C. L. Wickstrom, past president; W. R. Patton, a director; K. W. Goossens, secretary.

# CHAPTER NEWS

color film, "Naval Warfare—North Atlantic, 1957."

After the dinner the Executive Committee held a business meeting at which W. T. Edwards (USA, Ret.) of Southern Bell Tel. & Tel. Co., Columbia, S. C., was elected to succeed Colonel Oscar S. Tigner (USA, Ret.) as third vice president of the chapter. Col. Tigner has been transferred to Atlanta by Southern Bell.

On Saturday, the 12th of January, an interesting and informative tour of the Charleston Naval Yard was made by many of the members. This included inspection of a radar picket ship, and of the Charleston Minecraft Base where they saw an electronic repair shop and a minesweeper.

### *South Texas*

The January meeting of the chapter was held at the Randolph Field Officers' Club and was a joint meeting composed of representatives of the American Institute of Electrical Engineers, the Institute of Radio Engineers and the Research Society of America, in addition to the AFCEA.

A dinner and social hour preceded the highlight of the evening which was a talk given by the guest speaker, Mr. John M. Black, vice president of Southwestern Bell Telephone Co. of St. Louis, Mo. The subject of his address was "Future Developments in the Telephone Field."

### *Southern California*

Major General Alvin L. Pachynski, Director of Communications-Electronics USAF, was the principal speaker at the November meeting which was held at the Town House in Los Angeles.

Speaking on the trends in Air Force communications-electronics, General Pachynski stressed the factors responsible for rising costs in terms of resources required, and discussed the challenge imposed by the future.

**South Carolina** Chapter Meeting—left to right: W. T. Edwards; Admiral H. C. Bruton, Director of Naval Communications and guest speaker; S. C. Baughman; and R. S. Grist.

### *Southern Connecticut*

"The Operation and Mission of the Signal Equipment Support Agency" was the presentation made by Colonel R. B. Tomlinson, Commanding Officer, Signal Equipment Support Agency, Fort Monmouth, to the chapter's December dinner meeting.

Colonel Tomlinson covered the close relationship of his agency to industry, its interest in production and the "in-plant testing program" which is now part of Signal Corps production contracts.

The following slate of officers were chosen for 1957: president—Edwin P. Hurley, Southern New England Tel. & Tel. Co.; vice presidents—Charles Ecklund, Dictaphone Corp.; Spencer Montgomery, Jr., the Montgomery Co.; Rodney E. Nelson, Machlett Laboratories Inc.; secretary—I. T. Shapiro, Signal Corps Supply Agency; treasurer—Sidney Rosenberg, Signal Corps Supply Agency.

In January, Mr. F. W. Roberts, vice president—Engineering and Research Dictaphone Corp., was the chapter's guest speaker. He described and demonstrated some of the company's products. These ranged from a portable, pocket-size magnetic tape recording machine to a large, rack-mounted, magnetic tape logging-type recording machine.

**Southern California** Chapter meeting—from left to right are: Lt. Gen. Pete Quesada, director; Charles A. LaHar, president; Maj. Gen. Alvin L. Pachynski, Director of Communications-Electronics, USAF, principal speaker; Mr. Dave Callahan, director.

### *Switzerland*

The chapter held its January meeting at the American Community House, Geneva. Among the distinguished visitors present were Mr. Franklin C. Gowen, United States Resident Delegate and Consul-General, as well as a number of senior officials of the International Telecommunication Union.

Installation of the new officers elected in December took place.

The main attraction of the meeting was the film, "Voices under the Sea," prepared by The American Telephone & Telegraph Co., on the new trans-Atlantic telephone cables. In addition, two filmed United States TV programs were shown.

### *Tinker-Oklahoma*

The chapter held a joint dinner meeting in January with the local organizations of the Institute of Radio Engineers and the American Institute of Electrical Engineers.

Dr. Marshall Middleton, Jr., of the Westinghouse Electric Corp., was the principal speaker. He chose as his subject, "Product Design by Digital Computers." He discussed the application of an EDPM Computer (IBM 704) to the design of such products as induction motor, luminaires, and turbine generators.

Dr. Middleton also described the IBM 602A Electromechanical Computers, the Card Programmed Electronic Computers, the 650 Magnetic Drum Computers, and the 704 Electronic Data Processing Machine. He illustrated his talk with some very fine film slides.

### *Northeastern University*

The following report has been received on the activities of this chapter:

The students recently were invited by Western Union Telegraph Co. to dinner at its Boston Office, during the occasion of a Boston chapter meeting. The subject of the evening, automatic teletypewriter switching controls, proved to be of the highest interest quality.

The photographic section of the chapter is now busy on its newest motion picture project. The electronics group has decided to build all of the experimental stations suggested in the ARRL Course in Radio Fundamentals.

U. S. Army Photo

Firing of 280 mm Atomic Shell at Las Vegas Proving Ground in May, 1953. This shell was designed jointly by Picatinny Arsenal and Los Alamos engineers and scientists.

# ARMY ATOMIC MUNITIONS ARE BORN AT PICATINNY ARSENAL

Picatinny Arsenal at Dover, N. J., is composed of a group of Ammunition Development Laboratories responsible for Army ammunition technical development. Its responsibilities include research and development of ammunition for artillery, mortars, and recoiless rifles, mines, grenades, warheads for bombs and guided missiles, and rocket propellants.

One of Picatinny's principal laboratories is the Atomic Applications Laboratory, which is responsible for Army research and development of atomic munitions. This Atomic Applications group operates as the nerve center for all activities in atomic development for the Department of the Army.

To execute its mission responsibility, the Atomic Applications Laboratory draws not only on its "in-house" capabilities, but on the facilities of other Army arsenals, proving grounds, and on industry. Its "in-house" capabilities include an engineering technical organization that uses the full facilities and capabilities of the arsenal.

As well equipped as it is to solve the multitude of complex technical problems which confront it, Picatinny Arsenal has no greater asset than the long years of accumulated experience and unfailing loyalty of its career government employees. A recent example of its effectiveness is the crash program which resulted in the 280 mm Atomic Shell.

Picatinny's technical capabilities are utilized basically in expanding the frontier of mechanical, electrical and explosive development. The scientific personnel in organizations such as the Atomic Applications Laboratory will determine America's ability to meet potential aggressors with the most effective Atomic Weapons possible.

# ITEMS OF INTEREST
## From Government, Industry and the Services

### 1957 Reunion of SHAEF Signal Division

The editor of SIGNAL is very pleased to publish the following notice which was received from Major W.J.G. Barnett, M.B.E.R. Signals, of Sanderstead, Surrey, England.

It is particularly gratifying to note that Brigadier Harris is most keen to keep alive the splendid comradeship fostered during the war years.

"World War II American members of the SHAEF Signal Division will be interested to know that a number of their British colleagues met in London at the Waldorf Hotel on 22nd September 1956 at a SHAEF Signal Division Reunion Dinner. These reunions have been an annual event since 1948. General Vulliamy usually presides and Brigadier Harris has been a regular attender. There is always a great deal of reminiscing and the names of General Duke Lanahan, Colonel Henry, Colonel Young, Bim Behn, McCann, Murphy, Haight, Mitchell and many others crop up regularly when the 'battles are fought over again.'

"All too infrequently there has been American representation, but General Duke Lanahan, Colonel Ralph and Lt. Col. Rosso have attended past reunions.

"The 1957 reunion will be held at the Waldorf Hotel, Aldwych, London on 28th September at 7 p.m. and a most cordial welcome is extended to any of our American colleagues who may be in London at this time.

"Brigadier Harris, who is now Engineer-in-Chief of the British Post Office, says he will be very surprised if some of you cannot make it.

"The reunion secretary, Major W. J. G. Barnett, would be very glad to have news from any of you who happen to read this. His address is 'Braemarian,' Courtlands Close, Sanderstead, Surrey, England."

Pictured above is North American Aviation's new X-10, an unmanned test vehicle for the Air Force SM-64 NAVAHO inter-continental strategic guided missile program, which has been recently tested in flight at the USAF Missile Test Center, Florida. Called "an invaluable source of important data," the X-10 is powered by two turbo-jet engines and is provided with a landing gear so that it can be recovered for repeated use. Design and manufacture of the NAVAHO guidance and control systems is the responsibility of North American's Autonetics Division, and a third division, Rocketdyne, is building rocket engines for the missile, which will be rocket-boosted to flying speed and then powered by ram-jet engines. The NAVAHO will travel at supersonic speeds and very high altitudes, with great accuracy of delivery.

### Punched Card Transcriber For Use On SEAC

A punched card transcriber recently developed by the National Bureau of Standards (NBS) makes possible more rapid feeding of data into an automatic computer.

The device is designed to convert numbers and instructions recorded on punched cards into a binary serial code. In this form information is suitable for direct rapid input into the computer or temporary storage as a magnetic recording.

The system is about 150 times faster than the present paper tape inscriber and can handle up to 600 cards per minute. The transcriber is intended primarily for use with the NBS high speed electronic computer, SEAC. For a further report on SEAC, see our feature article on page 18.

### New Combat Surveillance Agency

The Department of the Army has announced the establishment of a new agency, the Army Combat Surveillance Agency (ACSA), which will be located in Washington, D. C.

The functions of the ACSA will be to coordinate and expedite the production of a combat surveillance system to be used by troop commanders. This system will use improved electronic equipment and techniques which will aid commanders in gaining battlefield information about the enemy.

The new agency will concern itself with research, development and test of techniques and equipment, production of equipment and systems, development of doctrine and procedures for its employment, and training of necessary technical personnel.

At the head of the new establishment will be Brigadier General Francis F. Uhrhane. General Uhrhane was formerly Chief of Research and Development for the Army Signal Corps.

### Edison Award

The first woman radio amateur to win General Electric's Edison Radio Amateur Award for public service has been presented with the Edison trophy at a banquet in Washington, D. C.

The 1956 winner is Mrs. Mary (Mae) Burke, W3CUL, a housewife, who is known throughout the world for voluntarily handling an average of 3000 messages a month in Morse code, many from far-flung military outposts. A licensed radio amateur since 1932, Mrs. Burke has handled 312,000 messages in the past seven years. Her longest stretch of operating without missing a schedule

(*Continued on page* 64)

was 1825 days, five years without taking a vacation or a single day off from her service.

"Mae" also operates at her home, 265 Waverly Road, Morton, Pa., a key station in the civil defense emergency communications network. This equipment features a gasoline generator power supply for use in the event commercial power lines fail.

The principal speaker at the banquet was Rear Admiral H. C. Bruton, Chief of Naval Communications. Dr. W. R. G. Baker, G-E vice-president, served as toastmaster, and the award was made by L. Berkley Davis, general manager of the G-E Electronic Components Division which sponsors the annual award.

## Electronics At Bendix

The Bendix Aviation Corporation, in its recent annual report by President Malcolm P. Ferguson, discussed for the first time the extent of its activities in the electronics field.

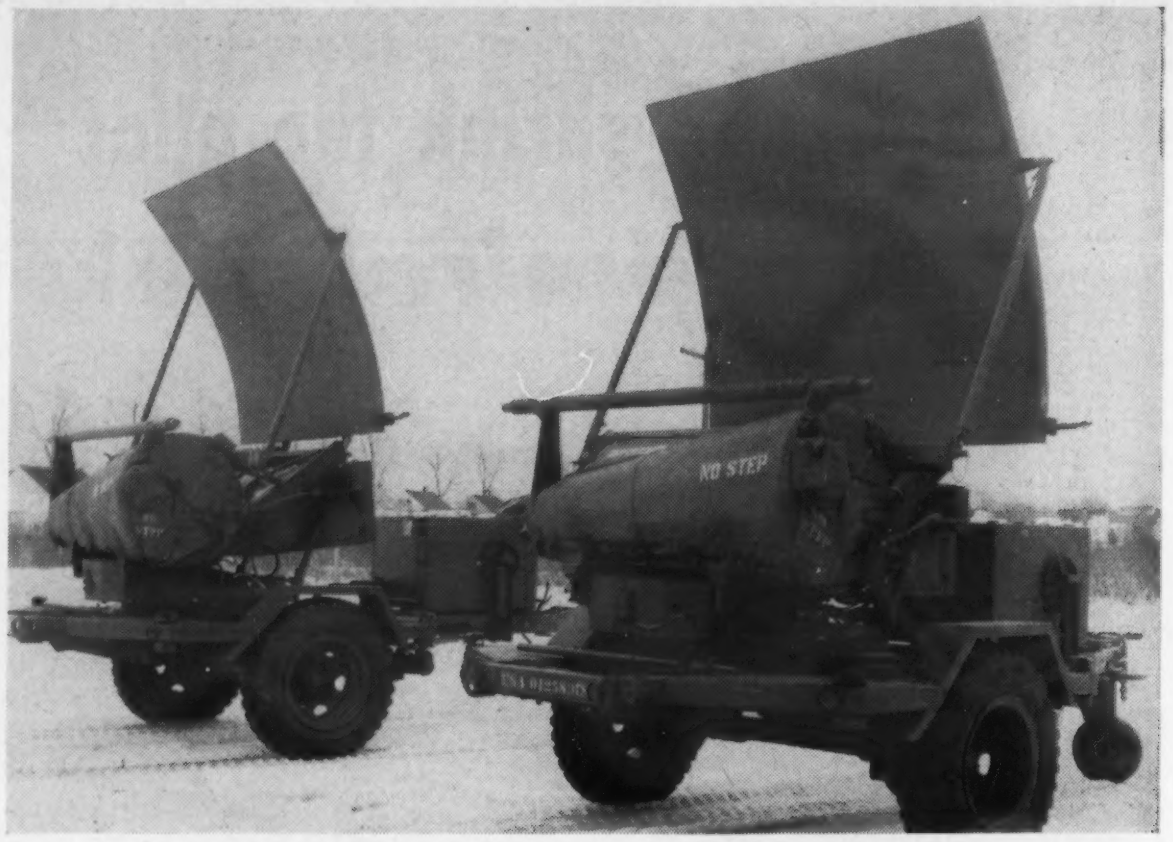
In his letter to stockholders, President Ferguson wrote that "Although outside the electronics field, the fact is not adequately appreciated that in terms of finished products utilizing electronic circuitries or controls, it constitutes, at least 40% of Bendix products' output." His report cited particularly the activities of Bendix Radio Division in supplying long-range search radar sets for the Air Force and in connection with the SAGE system as well as small, one manned "gap-filler" radars for the SAGE system. The report further pointed out that Bendix Radio Division was one of the leaders in developing and producing aviation, marine, and two-way radio communication equipment.

Bendix marine radar, in addition to serving on Coast Guard ships, is now being used in the hurricane study along the Atlantic Seaboard sponsored by the Oceanographic Institution of Woods Hole, Mass.

## New Intercommunication System

The first of a series of intercommunication systems for guided missile launching stations has recently been completed and delivered to the U.S. Air Force by Connecticut Telephone and Electric Corp.

Consisting of hundreds of telephone receiver units interconnected through specially integrated central amplifier stations, the system enables operators to reach any station instantly and to coordinate information essential for the proper launching of the missile.



Two New Radar Mortar Locators With Electronic Brain.

## New Radar Mortar Locator

A new radar mortar locator, with an electronic brain that pinpoints the location of an enemy position in seconds, has been perfected by the Army Signal Corps and the General Electric Company.

Signal Corps scientists reveal that the locator has a longer range than any known motor built today.

Its greatest advantage is speed. The AN/MPQ-4 locater, using a new beam technique, rapidly pinpoints the enemy mortar position. With this beam technique, the projectile appears as blips on the screen. The operator centers hairlines on the blips and the computer gives him a direct map coordinate reading of the enemy position. Relayed to an artillery battery, this information triggers immediate counter fire.

Compact and mobile, it can be operated either on the trailer or with the console in a foxhole 150 yards away for remote control and safety of the operator if the set itself should come under fire.

## Ptolemy Helps Modern Missiles

Scientists must keep in touch with missiles in flight to learn how they perform and how they can be improved. Recently, the mathematicians at the Lockheed Missile Systems Division became concerned with the fact that the magnetic tape system, used in recording the radio signals from a missile in flight, was not perfect for the job.

The sound recorded on the tape is subject to what engineers call "flutter" and "wow" or distortion as it is played back. The distortion is inherent in the data conversion unit which receives the information from different tones on the tape, but scientists can compensate for the distortion if they know what is happening in the system.

For this reason they began looking for a mathematical formula which could be used to chart a series of variations from the mean, or the average. The distortions they were trying to beat are essentially such variations themselves. They decided to employ a formula stemming from a technique that Ptolemy had once used to try to explain the puzzling variations of certain planets in relation to the stars.

The Lockheed experts tried this formula on their problem and it worked. As a result, the missile division expects to be able to process data much more swiftly and at the same time retain accuracy.

## British Research Into Scatter

Intensive research into tropospheric scatter is now being carried out in Great Britain.

Marconi Wireless Telegraph Co. Ltd. has established an experimental 200 mile tropospheric scatter link between the north and south of England, and hopes shortly to extend the link a further 200 miles into Scotland.

Plans are now in hand to set up high power transmitters and associated receivers at Newcastle, on the northeast coast of England. The object of these will be to operate up to 36 simultaneous telephone channels between these two points.

## New Pocket-Size Television Camera

A pocket-size live television camera has been developed by the Radio Corporation of America for Military airborne, mobile, and field closed-circuit TV applications.

It was made possible by a new design approach which combines transistors, specially developed transistor circuitry, and a new RCA half-inch vidicon camera tube.

The pocket-size TV camera (JTV-1) weighs less than a pound and measures only 1-7/8 by 2-3/8 by 4-1/2 inches; yet surpasses standard vidicon-type industrial TV cameras in sensitivity. Used with an F-1.9 lens, it requires only 10 foot candles of scene illumination for clear pictures.

The camera promises to open new fields of application for closed-circuit television, permitting direct observation and reconnaissance in places and locations heretofore inaccessible to existing TV camera equipment.

## Panelescent Lighting

Three new military naval applications, all using Panelescent lamps by Sylvania, have been introduced recently. They include a control panel, identification signs, and a tachometer.

The control panel, using the lamp, operates at 600 volts, 400 cycles, but can also be operated at lower voltages. The lamps can be utilized for single instrument dials, for instrument clusters, or for an entire instrument panel. Lamps are particularly adaptable to naval and marine usage for instrument dials, radar, binnacle lights, status boards, and other navigational or pilot-house areas.

The identification signs, such as aircraft "Fasten Safety Belts," use a Panelscent lamp behind a plastic cover on which the sign lettering is engraved.

The airplane tachometer indicator, manufactured by General Electric Co., is presently being tested with a Panelescent lamp.

The Panelescent lamp is a device which produces light by the principle of electroluminescence which is the creation of light by the excitation of certain phosphors placed in an electric field. Only 25 one-thousandths of an inch thick, the lamp produces a uniform light without the use of bulbs, tubes, filaments, or cathodes. In its present construction, it consists of porcelainized steel with a ceramic-phosphor coating.

It has a number of major advantages for military-naval applications. They include its thinness, or flatness of light source; its ruggedness; its long life; its economy of operation; its low operating temperature; and its ability to withstand severe temperature changes.

## New Reactor Center

A Nuclear Reactor Center has been established in West Caldwell, N. J., by Daystrom, Inc.

The "Argonaut" reactor is to be installed in a 36,000 square foot laboratory. In this lab, college and university faculty members throughout the country can be trained in the peacetime use of nuclear reactors. In this Nation's newest nuclear center, Daystrom Nuclear will also go into quantity production on a 10 kilowatt "Argonaut" research reactor that will be available for the first time to colleges and universities, as well as to industry.

The purpose of this new Daystrom Reactor Training is to implement the vast peacetime atomic training program which is to be sponsored by the Atomic Energy Commission.

## Annual Conference On Electronics In Industry

The Professional Group on Industrial Electronics of the Institute of Radio Engineers and the Armour Research Foundation will jointly sponsor an Annual Conference on Electronics in Industry.

This conference will be held April 9th and 10th in Chicago, Illinois.

The following papers will be read:

Session I—"Basic Instrumentation" by Dr. W. A. Wildhack, National Bureau of Standards; "Communication Problems between Instruments, Controls and Man" by H. B. Ziebolz, Askania Regulator Co.; "Economic and Technical Aspects of Industrial Electronics" by Dr. Ellsworth D. Cook, General Electric Co.

Session II—"Application of Magnetic Amplifiers in Industrial Instrumentation and Control" by Dr. William A. Geyger, Naval Ordnance Laboratory; "Principles and Techniques for Direct Reading Digital Transducers" by Dr. Waldo H. Kliever, Consultant; "Solid State Devices in Industrial Electronics" by Dr. Lloyd DeVore, Stewart-Warner Corporation.

Session III—"Electronics in a Chemical Company" by R. C. McMillan, E. I. duPont de Nemours & Co., Inc.; "Some New Aspects of Nuclear Instrumentation in Indus-

trial Electronics" by Nicholas C. Anton, Anton Electronic Laboratories, Inc.; "Process Monitoring by Dielectric Constant" by Wilfred H. Howe.

Session IV—"Automatic Card Programmed Control of Reversing Rolling Mills" by E. H. Browning, Westinghouse Electric Corp.; "Some Application of Analog Computer Techniques to Control System Design" by Ernest Goggio, Tammen and Denison, Inc.; "Selection of Reliability Levels in Equipment Design" by Dr. Harold Garbarino, Armour Research Foundation.

## Raytheon Forms New Laboratory

A new electronics laboratory at Maynard, Mass., whose responsibility it will be to design and develop airborne equipment, has been formed by Raytheon Manufacturing Company of Waltham, Mass.

The laboratory will work on such devices as Doppler navigation instruments, aircraft intercept radars, altimeters, surface radars, and other classified items for the Defense Department.

Serving as a nucleus for the laboratory will be engineers and technical employees transferred from the firm's former aircraft systems department. The laboratory will be self-sufficient, housing all its own supporting services as an integral part of the organization.

## Two New Air Force Test Missiles

Two new research missiles, especially designed by Lockheed Missiles of California to combine highest performance with low cost, are saving U.S. taxpayers millions of dollars as the Nation's missile program moves forward.

The test "birds," called the X-7 and the X-17, go through the paces of regular operational missiles. However, the X-7 ramjet vehicle is recovered from supersonic flight by parachute to fly again. The X-17, only a fraction as expensive as the long-range ballistic missiles it simulates, is used to provide information on the problems which arise when the warhead of a ballistic missile reenters the earth's atmosphere at high speed. In order to do this, the test missile hurtles out through the earth's atmosphere at speeds far in excess of the velocity of sound. Within seconds after it is fired the missile blasts through the sonic barrier and pierces the ionosphere. It then plunges at tremendous speeds from the ionosphere back into the earth's heavy blanket of air.

## NEC Conference

The Nation's leading forum on electronic research, development and application, the National Electronics Conference, has selected the following dates for its future meetings:

1957—October 7, 8 and 9 at the Hotel Sherman, Chicago, Ill.

1958—October 13, 14 and 15.

## Navy-AEC Skyhook Balloon

The first of a series of SKYHOOK balloon flights has been launched from Guam and has reached an altitude of 108,000 feet. The plastic SKYHOOK balloon, manufactured by Winzen Research Inc., Minneapolis, Minn., was launched for the Office of Naval Research and the Atomic Energy Commission.

Guam was selected as the launching site because of its proximity to the Geomagnetic equator. In this region the earth's magnetic field filters out of the cosmic ray flux all but the very high energy particles. The consequent reduction in low energy background permits easier and more accurate interpretation of experimental results.

Data obtained from these flights should provide scientists with a better understanding of these particles and may eventually lead to applications in such practical fields as communications and electronics. Magnetic storms that disrupt communications are associated with sun spots which affect the energy distribution and total flux of cosmic rays. More precise measurements of the fluctuations in cosmic ray activity may permit a correlation of these two phenomena which may ultimately lead to the ability to predict periods of poor communications due to solar storms, much as weather is predicted today.

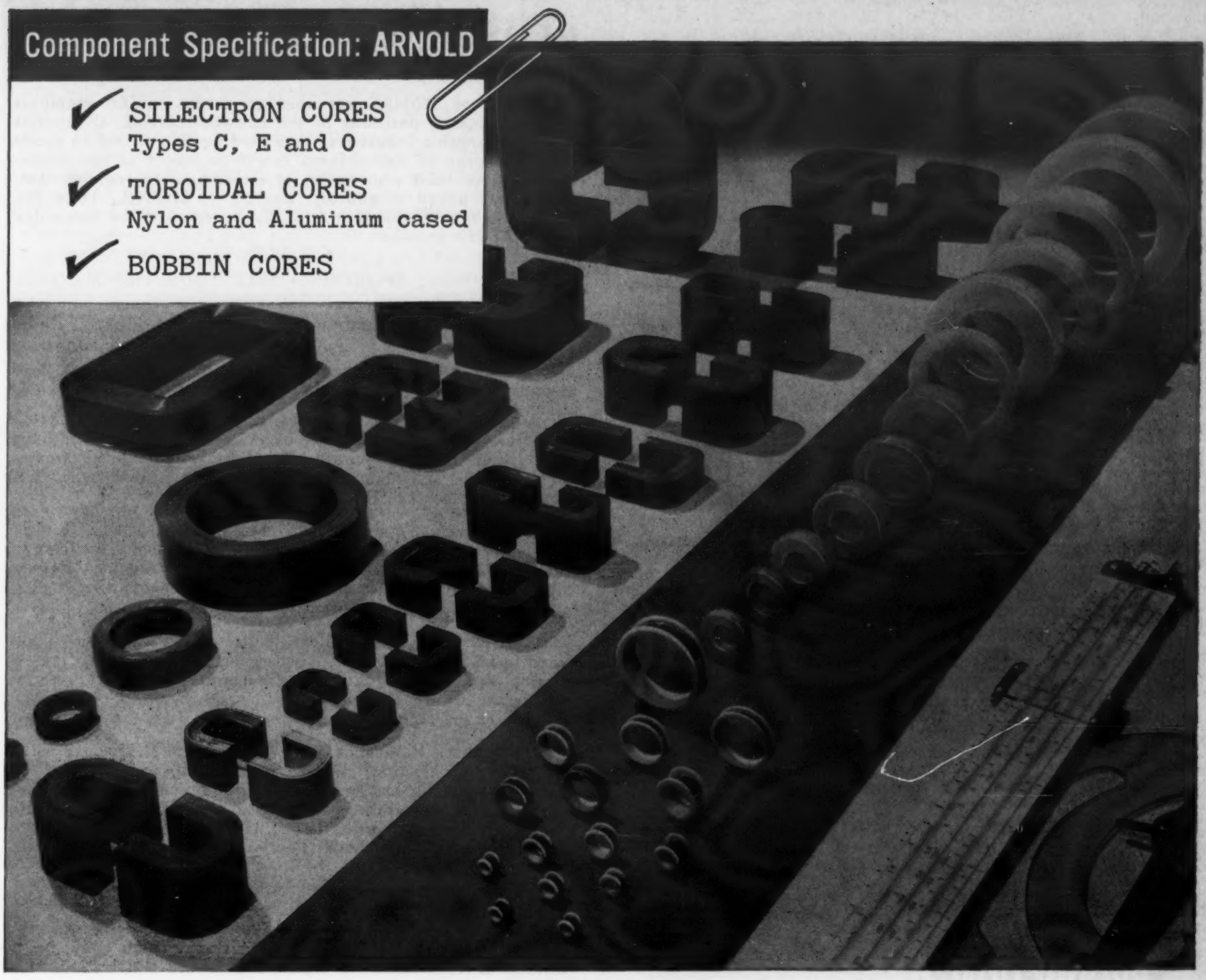
## New Radar Moving Target Simulator System

A new Radar Moving Target Simulator System which will generate the display of up to six individual moving targets on any standard radar indicator, has been developed by the Electronics Division of Fairchild Controls Corp.

The system is one of the new, specialized devices being engineered and manufactured for all branches of the Armed Services and prime military contractors.

Two models are currently avail-

(*Continued on page* 69)

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**TC-108**—*Bobbin Cores*

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# PERSONNEL CLEARING HOUSE

## *AFCEA Members Available to Industry*

**The pages of SIGNAL are open to active AFCEA members who are seeking positions in the communications, electronics and photographic industries. Any member is entitled to space free of charge in this column for three issues of the magazine. Please limit your notice to five lines. In replying, employers are asked to address: Box ....., SIGNAL, 1624 Eye Street, N. W., Washington 6, D. C. Letters will be forwarded to the AFCEA member.**

SALES ENGINEER: ADVERTISING—SALES PROMOTION MANAGER. Recent sales experience plus 10 years' experience in advertising and sales promotion of electronic products. Radio amateur for over 20 years. Age 37. Engineering education of 3 years and B.S. in Marketing. Prefer West or East coasts. Box 121.

COMMUNICATIONS SPECIALIST—COMMUNICATIONS SYSTEM MANAGER with leased long-line interphone experience plus 10 years military and civilian air traffic control. Broad background in electronics, air operations, and flight movement. AB and LLB degrees. Will consider any location. Box 122.

FIELD ENGINEER: ELECTRONIC, COMMUNICATION, MARINE EQUP'T. Data processing and automation. DOD project coordination. Branch Management, sales promotion, customer relations. Surveys and reports, subcontract and material expediting, program planning, production control, priorities. Box 123.

REPRESENTATIVE, with all clients performing R & D or supply work for Wright Field and other agencies, needs more lines to develop with both military and commercial potential. Preferred are electronics or photographic equipments and ANP (have AEC Access) or packaging material. Box 124.

MANUFACTURERS REPRESENTATIVE WASHINGTON, D. C. Long established and contacting all government procurement points in Washington, D. C., has opening for an additional account. Prefer a company manufacturing an end-use item and who is already doing some business with the military. Can also cover Philadelphia and Fort Monmouth. Replies confidential. Box 125

## *Government and Military Positions Available*

**Government and military agencies are invited to use this column to announce available positions which may be of interest to the readers of SIGNAL. Notices will be published three times if not cancelled before. Applicants apply as indicated in individual notices.**

ORDNANCE ENGINEER ($7,000 a year). Assistant Inspector of Naval Material, Germantown, Pa., has opening in development and production of ordnance equipment. Requirements: Bachelor's degree in engineering (or four years' equivalent experience) and 2½ years' engineering experience, one in ordnance engineering. Master's degree can be substituted for one year's experience; Doctor's degree in ordnance engineering can be substituted for all experience. For further information, write: Supervising Inspector of Naval Material, 17 Brief Ave., Upper Darby, Penna.

ELECTRONIC ENGINEERS, ELECTRONIC SCIENTISTS, MECHANICAL ENGINEERS, starting salaries $5,335-$6,390. ENGINEERING DRAFTSMEN, $3,415-$4,080. Vacancies now exist at the U. S. Navy Electronics Laboratory, a major West Coast scientific organization engaged in research and development of electronic equipment and systems. For further information address: U. S. Navy Electronics Laboratory, Civilian Personnel Division, San Diego 52, California.

ELECTRONIC ENGINEERS: One Electronic Engineer (telephone) and one Electronic Engineer (radio), starting salary $6,390. Requirements are: degree in electrical engineering and 2½ years professional experience, one year of which must have been in the specialized field, or 6½ years professional electronic engineering experience. Applications should be forwarded to: Hqs., 5001 SU Station Complement, 5th Army, 1660 E. Hyde Park Blvd., Chicago 15, Illinois.

THE SPECIAL DEVICES CENTER, an activity of the Office of Naval Research, located at Sands Point, Port Washington, Long Island, has several vacancies for electronic engineers at $7035 a year and for Engineering Draftsmen at $4080 a year.
Inquiries should be directed to the Industrial Relations Officer. Telephones: Flushing 7-8300 and Port Washington 7-3800.
RADIO OPERATOR TECHNICIANS. Veterans $3400-$4200 to start. Overseas opportunities. Amateur or commercial licenses helpful. Full pay during advance training. Good advancement opportuni-

ties. Submit resume with name, age, address, phone number—if any, military experience, private training, work experience, FCC licenses—if any. Armed Forces Communications and Electronics Association will forward same immediately to employer who will acknowledge your application direct.

TELETYPE OPERATORS AND CRYPTOGRAPHIC TECHNICIANS. Veterans $3200-$3700 to start. Overseas opportunities. Full pay during training period. Good advancement opportunities. Submit resume with name, age, address, phone number—if any, military experience, FCC licenses—if any. Armed Forces Communications and Electronics Association will forward same immediately to employer who will acknowledge your application direct.

ELECTRONIC TECHNICIAN ($7570 to $8645 plus 25% (non-taxable) cost of living allowance). Major duties are to plan, direct and supervise the operation and maintenance of carrier, repeater, terminals, telegraph and associated equipment installed in the toll test rooms. Includes inspections of facilities to determine required training, the organizing of the training and when necessary the actual conducting of the training. Three years general experience required and three years specialized experience. Inquiries should be directed to Civilian Personnel Officer, Alaska Communication System, 550 Federal Office Building, Seattle 4, Wash.

ELECTRONIC ENGINEERS GS-5 through GS-12. These positions have a salary range of $4480 through $8645 per annum. Employees in these positions serve as advisors and consultants to Signal Corps Contracting Officers on technical phases of procurement of Signal Corps equipment during the period of solicitation and during the life of the contract. Submit resume and the Armed Forces Communications and Electronics Association will forward same immediately to employer who will acknowledge your application direct.

SUPERVISORY GENERAL ENGINEER ($6950 a year). To serve as an assistant to the military post engineer. Function of the Depot Facilities Division is related to maintenance, care and preservation of all buildings, structures, and rights-of-way and other real estate of the depot; responsible for fire protection and prevention for the depot; and management of depot facilities. Inquiries may be directed to the Civilian Personnel Office, Decatur Signal Depot, Decatur, Illinois.

EAST COAST PICTORIAL CENTER has an opening for a studio electrician at $2.51 an hour. Duties include operating most electrical equipment, required for motion picture production. Knowledge of lighting effects and switchboard wiring required. A position is also available for an architectural draftsman at $4,525 a year. Situation requires ability to execute designs and plans for motion picture settings, and to paint and dress sets, dioramas and other pictorial representations. Clerical duties include filing, developing and printing of blue prints, and a minimum amount of typing. For further information, write to Civilian Personnel Office, Army Pictorial Center, Long Island City 1, N.Y.

PHYSICIST—GS-9. Qualified expert on radiology responsible for the operation of the film badge service unit and for the monitoring of personnel, material, equipment and radioactive sources. Accountant—GS-9. Responsible for receiving and analyzing all reports generated by the Finance and Accounting Branch; practical application of accounting theories. Cost Accountant—GS-9. Serves as Staff Accountant for the Maintenance Division responsible for performing professional accounting work in connection with cost accounting and Army Industrial Fund activities. Electronic Engineer—GS-7. Responsible for independent accomplishment of professional engineering work as related to research, development, design, evaluation, standardization, modification, etc., of prototype production and fabrication models of electronic equipment. Inquiries should be directed to the Civilian Personnel Director, Lexington Signal Depot, Lexington, Kentucky.

MEDICAL OFFICER GS-12. This position pays $8645 per annum. The employee will be responsible for the operation of a Federal Civilian Health Service type of dispensary containing examination and treatment rooms and equipment. Examines military personnel having initial responsibility for diagnosis and disposition of cases for treatment. Submit resume and the Armed Forces Communications and Electronics Association will forward same immediately to employer who will acknowledge your application direct.

### FORT MONMOUTH VACANCIES

Supv. Physicist (General), GS-14; Electronic Engineer (General), GS-14.

*Duty Station:* Pasadena, California.

Electronic Engineer (Radio), GS-13.

*Duty Station:* Christ Church, Hampshire, England.

Electronic Engineer (General), GS-13; *Duty Station:* Fort Monroe, Va., Fort Knox, Ky., Fort Bliss, Texas, and Fort Rucker, Ala. Electronic Engineer (Radio, Instrumentation), GS-12; Chemical Engineer, GS-11; Electronic Engineer (Radio, General & Wire Communications), GS-11; Mechanical Engineer (S&S, Signal Equipment), GS-11; Training Officer (General Fields), GS-11; Mechanical Engineer and Mechanical Engineer (Signal Equipment), GS-9; Employee Utilization Representative, GS-9; Instructor (Radar, Radio-Microwave, Wire Sound Recording), GS-9; Radio & Electronic Equipment Installer and Repairer, WB-15.

## ITEMS OF INTEREST

(*Continued from page 66*)

able—one for laboratory installations and one for mobile field use.

The Model TSS-50 system for laboratory installations consists of six Target Simulator Units and one Sync/Power Unit enclosed in a steel cabinet. It provides for the immediate viewing of up to six separate moving targets on standard radar indicators. Aircraft and missile speeds up to 10,000 nautical miles per hour are easily generated.

The smaller field-type Target Simulator System, Model TSS-52, is similar to the laboratory installation in its functions. It is able to trace up to six simulated targets but contains only one set of meters, capable of monitoring one target at a time.

### IEE Meeting

The Institute of Environmental Engineers is a newly incorporated engineering society devoted exclusively to environmental science, simulation and testing.

This year, the IEE will sponsor its first annual technical meeting. It has been set for April 25 and 26 and will be held at the LaSalle Hotel, Chicago, Ill.

### RCA Elects Two Top Executives

Frank M. Folsom has recently been elected Chairman of the Executive Committee of the Board of Radio Corporation of America. Mr. John L. Burns has been chosen to succeed him as President and Director of the company.

The new president had been a senior partner and vice chairman of the Executive Committee of the management consultant firm of Booz, Allen and Hamilton.

In speaking of the new positions, David Sarnoff, Chairman of the Board of Directors, said: "Mr. Burns is no newcomer to RCA, for he has been intimately associated with our activities for the past ten years. He has worked closely with us in our periodic reviews of the company's objectives, policies, organization planning and our business programs and operations.

"This action was taken at the request of Mr. Folsom, who informed me of his intention of retiring from active service upon reaching retirement age in two years. He asked that his successor as president be selected at this time to permit an orderly transition in management."

### Holschuh Named President Of Sperry Gyroscope

The appointment of Carl G. Holschuh of Huntington, Long Island, as president and general manager of Sperry Gyroscope, has been announced.

Mr. Holschuh joined the company in 1933, devoting his early efforts to Sperry's extensive program in gunfire controls. During the war years, he advanced to assistant research director and was responsible for Sperry gunsight and turret developments for the B-17 Flying Fortress.

Previous to his present appointment, he was concerned with the organization of Sperry Gyroscope into several specialized divisions devoted to product family activity in such fields as aeronautical and marine equipment, electron devices, and air and ground weapons systems.

# "An infinite capacity for taking pains"

The above familiar phrase is usually given as a definition of genius. We borrow it as a job description.

The lengths to which our Quality Control people go, to insure the reliability of our complex products, are truly painstaking, and are applied equally to components we make ourselves and those we purchase from outside suppliers.

For example, consider vacuum tubes, the heart of hundreds of projects in our Electronics Division. No spot check satisfies here (even if that's all our customer specifies)—but a whole series of critical tests, including such precise evaluations as these:

*Inspection of tube characteristics* to rigid Stromberg-Carlson specifications—performed on special equipment which can do in a half-hour what would take days on conventional testing devices.

*Inspection by X-ray,* looking for deeply hidden potential faults which could cause malfunction at any time after first use.

*Inspection by microscope,* seeking welding faults, minute cracks in glass, and even infinitesimal loose particles inside the tube.

And tubes are only one concern. *All* components must pass similarly rigid tests, to assure operating performance, ruggedness and reliability in the completed equipment.

You can't put a price on "taking infinite pains." You *can* place your confidence in a company where this is everyday procedure.

S-C STROMBERG-CARLSON

**STROMBERG-CARLSON COMPANY**

A DIVISION OF GENERAL DYNAMICS CORPORATION

General Offices and Factories at Rochester, N. Y.—West Coast plants at San Diego and Los Angeles, Calif.

GD GENERAL DYNAMICS

# NEW PRODUCTS FROM INDUSTRY

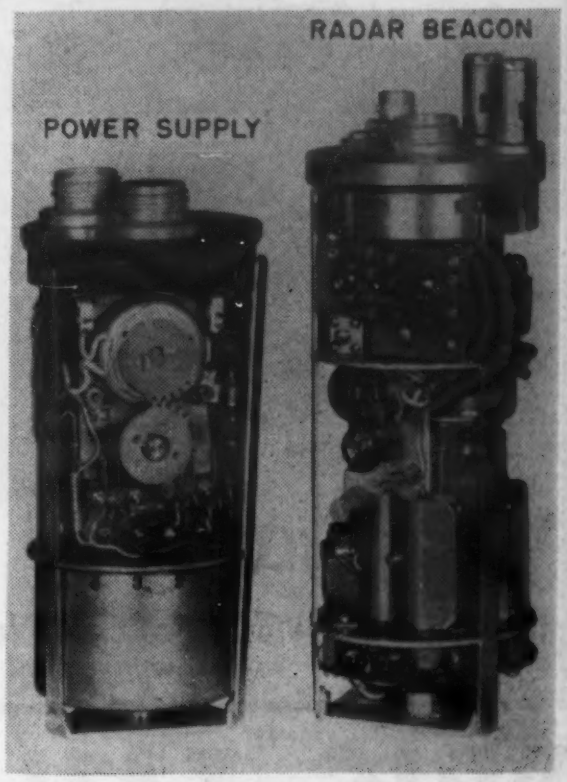

*Cover: Courtesy of American Machine & Foundry Corp.*

## Missile with Radar Beacon

SIGNAL'S cover picture, an artist's conception of a guided missile shows the radar beacon in the cut-out. The improved radar beacon, produced by American Machine & Foundry Co., 261 Madison Ave., New York 16, N. Y., tracks rockets and guided missiles. A similar radar beacon is being manufactured also for the Armed Forces and has been tested successfully with all types of missile and drone equipment.

The complex sub-miniature components and circuitry of the radar beacon include a receiver-transmitter, power supply unit, and antenna. They are pictured at the right.

The life expectancy of the beacon is over 50 hours when an external power supply is used, and the self-contained battery operates for about 15 minutes. The extremely compact beacon weighs only four pounds.




**Sub-miniature components and circuitry**

## Highway Hazard Flasher

Development of a wholly transistorized electronic highway hazard flasher was disclosed by the R. E. Dietz Co., of Syracuse, N. Y.

The application of an electronic circuit to a highway hazard light is practical now only because of the invention and development of transistors. Use of transistors in the electronic circuit assures long battery life up to 18,000 working hours at full power. This is the equivalent of six years at eight hours a day. Ruggedness tests show that transistors can withstand the shock of being fired from a mortar and still operate.

The new electronic highway flashers are expected to be a boon to construction concerns, municipal highway maintenance departments, and other organizations that need reliable and rugged hazard flashers.

## New Transistor Clip

Atlas E-E Corp., 47 Prospect St., Woburn, Mass., has announced a new design in transistor clips. A silver-plated beryllium copper clip will hold all Transistors .235" x .375" including the GE 2N167 and 2N78, and Texas Instrument Silicon types.

Split to insure a tight four point grip, the clip has a stop tab that prevents the transistor from moving longitudinally. An integral tab reinforces the single mounting hole to prevent twisting out of place.

## Radome Testing System

The CTI Radome Boresight-Error Measuring System, Model 150, is important to the manufacturer of plastic radomes as well as to aircraft and engineering firms installing and testing radar equipment.

The California Technical Industries (formerly Color Television, Inc.), 1512 Old County Road, Belmont, Cal., has announced that this system is available not only in a complete system, but for transmission efficiency measurements, for antenna pattern plotting. To augment existing antenna ranges, combinations and modifications of the basic components are available separately.

The Radome Testing System records the beam deflection in a radar tracking system. This automatically continuous function of the radome requires far less time and is far more accurate than manual, point-by-point measurements.

The transmitting parabola on the end of a Null-Seeking Boom directs a pencil beam at the radome and receiving antenna located at the other end of a 1500-inch range. The received signal, by means of a servo system, positions the Boom to the apparent axis of the receiving antenna as seen through the deflecting radome. While the motor-driven Radome Holding Fixture rotates, three recorders, synchronized with the position of the radome, plot the magnitude and the horizontal and vertical components of the beam deflection angle as represented by the position of the Null-Seeking Boom.

## New Cathode Material Designed for Electronic Tubes

A passive cathode material with nearly doubled strength has been developed by Superior Tube Co., Norristown, Pa., manufacturers of small diameter tubing and precision electronic products.

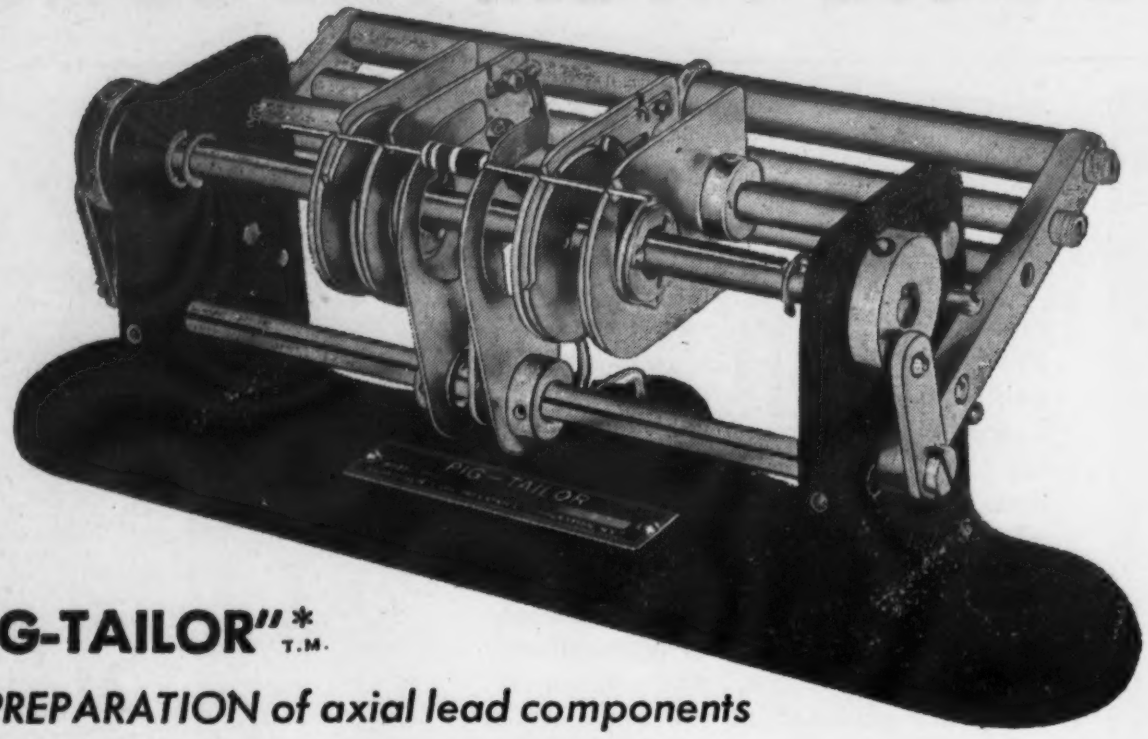
Designated as Cathaloy P-51, the new alloy is similar to Superior's Cathaloy P-50 in chemical composition and electrical characteristics but contains four percent tungsten to increase its strength. Hot yield strength is about 5,000 pounds per square inch at 800 degrees Centrigrade.

Cathaloy P-51 is designed for electronic tubes which require the low rate of barium evolution, with minimum sublimation and freedom from interference impedance characteristic of passive cathodes, but which operate under conditions of shock and vibration. It is especially useful in ruggedized tubes.

Customers' exact dimensional specifications are supplied in seamless, Weldrawn (welded and cold drawn), and Lockseam forms. Cathaloys P-50 and P-51 also are furnished as emission caps and shanks in disc cathodes.

*(Continued on page 73)*

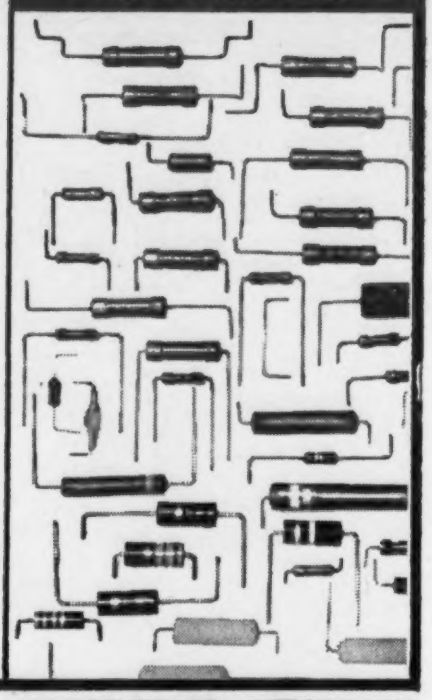
# PROVEN-on the assembly line!



**"PIG-TAILOR"*** T.M.

*For PREPARATION of axial lead components*

**PREPARED COMPONENTS IN SECONDS WITH THE "PIG-TAILOR"**



# "PIG-TAILORING"

***. . . . a revolutionary new mechanical process for higher production at lower costs. Fastest PREPARATION and ASSEMBLY of Resistors, Capacitors, Diodes and all other axial lead components for TERMINAL BOARDS, PRINTED CIRCUITS and MINIATURIZED ASSEMBLIES.***

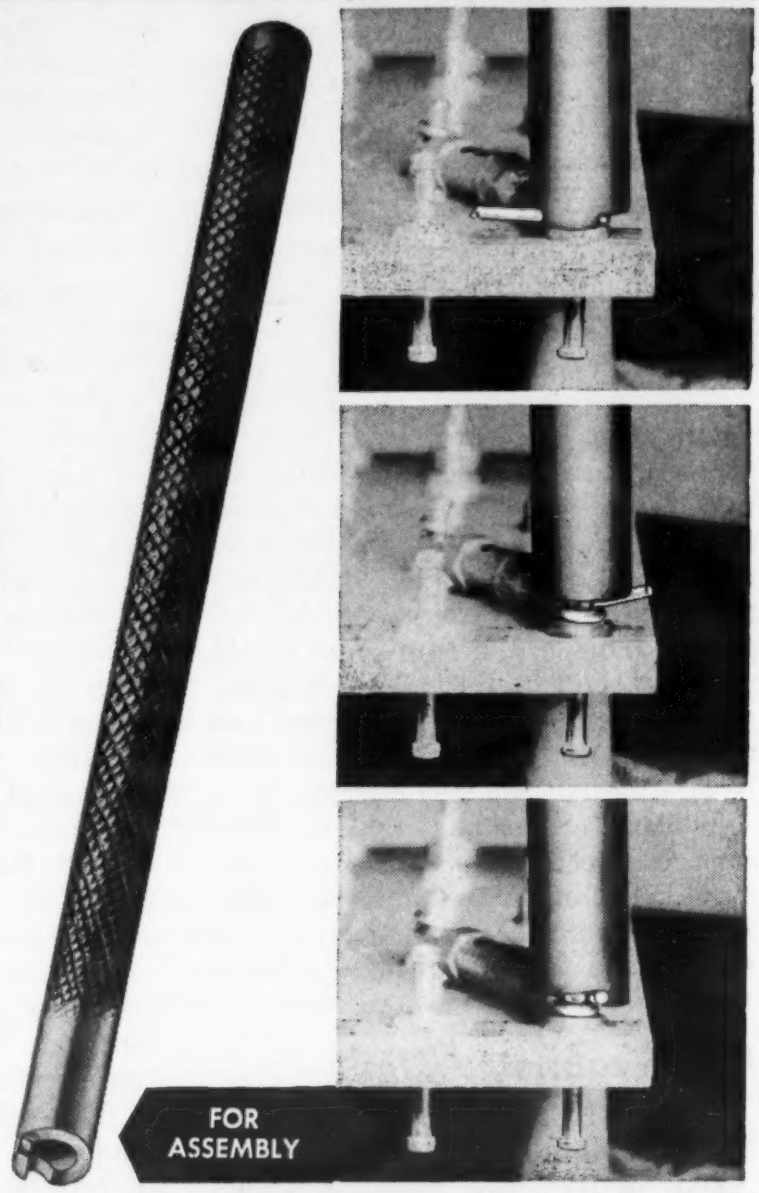
The "PIG-TAILOR" plus "SPIN-PIN"—accurately MEASURES, CUTS, BENDS, EJECTS & ASSEMBLES both leads simultaneously to individual lengths and shapes—3 minute set-up—No accessories—Foot operated—1 hour training time.

**PIG-TAILORING provides:**

1. Uniform component position.
2. Uniform marking exposure.
3. Miniaturization spacing control.
4. "S" leads for terminals.
5. "U" leads for printed circuits.
6. Individual cut and bend lengths.
7. Better time/rate analysis.
8. Closer cost control.
9. Invaluable labor saving.
10. Immediate cost recovery.

**PIG-TAILORING eliminates:**

1. Diagonal cutters!
2. Long-nose pliers!
3. Operator judgment!
4. 90% operator training time!
5. Broken components!
6. Broken leads!
7. Short circuits from clippings!
8. 65% chassis handling!
9. Excessive lead tautness!
10. Haphazard assembly methods!




**"SPIN-PIN"*** T.M. Close-up views of "SPIN-PIN" illustrate fast assembly of tailored-lead wire to terminal.

* PATENT PENDING

*Write for illustrated, descriptive text on "PIG-TAILORING" to Dept. S-3P*

**BRUNO-NEW YORK INDUSTRIES CORPORATION**

DESIGNERS AND MANUFACTURERS OF ELECTRONIC EQUIPMENT

460 WEST 34th STREET • NEW YORK 1, N. Y.

# NEW PRODUCTS

## Lawrence Color Tube

A recent agreement between Litton Industries, Beverly Hills, Cal., and Paramount Pictures Corp. will enable a part of Litton, the Emeryville organization, to devote its facilities and scientific manpower to the application of the Lawrence tube to military and industrial uses. The unique tube was developed by Chromatic, a subsidiary of Paramount.

In air traffic control the tube presents landing planes in one color, planes taking off in a second color, and planes within a given distance in a third color on the display panel.

The Lawrence color tube makes it possible to select color displays in radar presentation. Thus, enemy planes can be identified and distinguished from friendly aircraft on a radar screen by their color image.

Paramount Pictures Corp. President Mr. Barney Balaban said, "In both military-industrial and home television cases, the vastly increased image brightness of the Lawrence tube, the simplified circuitry it has made possible, and the resultant lower cost of manufacture will make possible superior performance at lower cost."

## "Maintz" Protective Coating

A new coating which provides excellent protection against severe chemical and weather exposure has been introduced by the West Chester Chemical Co., West Chester, Pa.

"Maintz" is based on DuPont's chlorosulfonated polyethylene which, combined with silicone and other resins, produces an exceptionally tough and long lasting coating that resists abrasion, weathering, and chemical corrosion. It is elastic enough to withstand extremes of expansion or contraction without cracking and retains this property at temperatures as low as –40 F. Repeated rapid and severe changes in temperature can be tolerated without damage over a range of from –50 Centigrade to 150 Centigrade.

A chemically inert substance, "Maintz" resists oxidation, ozone, acids including nitric and chromic, chlorine solutions, alcohols, refrigerants, ethers, etc. Tests of exposure to salt spray and tropical weather for over two years have shown no measurable degradation.

Recommended applications of "Maintz" include refineries, chemical plants, marine service, or any other locations where severe conditions present problems in maintaining a protective coating.

Vacuum-Tube Voltmeter is assured greater accuracy by its design and construction.

## Vacuum-Tube Voltmeter

The accuracy of a laboratory instrument is combined with the durability necessary for everyday laboratory and production use in the Type 1800-B Vacuum-Tube Voltmeter offered by General Radio Co., 275 Massachusetts Ave., Cambridge 39, Massachusetts.

High accuracy of the new voltmeter is assured by its design and construction. It is greater than $\pm 2\%$ accurate on all A-C and D-C voltage ranges. This has been achieved through advanced circuit design, power-supply regulation, and the use of long-term stable precision components.

The completely shielded diode probe is designed for use into the UHF range. Other features include a high input impedance, D-C polarity switch, illuminated meter scale with mirror and knife-edge pointer, and input terminals that are insulated from the panel so that the panel is grounded at all times. Priced at $415 net F.O.B., complete with probe.

## New Amplifier Klystron

A new klystron tube, the VA-806, has been introduced by Varian Associates, Palo Alto, Cal., for use as the final amplifier of a high power microwave transmitter.

The VA-806 has performance characteristics that permit amplification of frequency, amplitude, or phase modulated signals at power gains on the order of 50 db. It features a unique all-ceramic and metal construction.

VA-806 provides 2,000 watts of continuous power in the 7125 to 8500 megacycle frequency range. It is a water cooled, four cavity cascade amplifier, tunable $\pm 25$ megacycles from the specified center frequency.

## Missing Pulse

An instrument to check the performance of pulse-modulated tubes like magnetrons and klystrons is a recent addition to the specialized tube testing equipment of Manson Laboratories, 207 Greenwich Ave., Stamford, Conn.

Called the "Missing Pulse Detector," Model PD11A incorporates two input connectors, one for the negative detected RF pulse, the other for a negative reference trigger. A positive pulse registers on the counter if a pulse is missing. Under normal operation, no output pulses appear.

The set can check pulses from 0.2 to 6.0 microseconds in width at repetition rates up to 5000 pps. It requires 115 volts, 60 cps., 20 watts.

## Slotted Line for Wave Guide

Developed to fill a need in the ever expanding field of lower frequency radars and scatter communications systems, the Slotted Line is offered by I-T-E Circuit Breaker Co., 19th & Hamilton St., Philadelphia 30, Pa.

The Slotted Line for waveguide features bolted and dowled aluminum construction with probes tunable over the entire frequency band.

The inherent VSWR is less than 1.02 over the entire applicable band; the slope is under 1.005 VSWR.

Military and commercial installations currently are being supplied with instruments that range in size from WR-770 through WR-2300. They are designed to withstand severe field service under various adverse conditions.

## Multi-Channel Programmer

To satisfy the need for a small programming device, the exceptionally accurate MPR-13 Multi-Channel Programmer offers many advantages never before accumulated in one package. It is small, light, and provides up to 13 channels for any type of electrical programming. The unit is produced by Photographic Products Inc., 1000 No. Olive St., Anaheim, Cal.

The accuracy is of the order of one part in approximately fifty thousand. The general operating principle provides for an insulating tape similar to 35mm photographic film to be advanced at a precise rate of speed between 13 contractors. The tape is marked lengthwise in time and divided into 13 channels. Up to 13 types of signals, both repeat cycling or random nature, may be generated to control accurately a group of electrically operated equipment.

The unit was designed to withstand the rigors of missile and aircraft useage. For utmost ruggedness, the Programmer is manufactured to extremely close tolerances and housed in a magnesium casting which gives strength and resistance to shock and vibration.

The Slotted Line for Wave Guides, manufactured by I-T-E Circuit Breaker Co., Philadelphia, Pa., fills a need in the fields of radar and scatter communications. Instruments similar to the one pictured above currently are being supplied for both military and commercial installations.

## Major Breakthrough in Connector Reliability

Integral Connector Insulation molded directly onto contacts and leads provides fool-proof, tamper-proof connector cables for trouble-free field operation.

Unique design and special production processes called the Alden "IMI" (integral molded insulation) Connector Technique will be unveiled at the New York I.R.E. Show by Alden Products Company of Brockton, Massachusetts.

This technique now makes it possible to supply molded unit cables in which the contacts and leads are molded with one hot shot of connector insulation into connector bodies integral with their cables. The designs eliminate tedious and critical assembly operations, reduce the population of parts in connector designs to a basic minimum, provide positive moisture seal and protect leads and contacts from shock and vibration.

## Low Cost Telephone Carrier System

Budelman Radio Corp., 375 Fairfield Ave., Stamford, Conn., announces immediate availability of a new, low-cost private line telephone carrier system.

Designed specifically to provide high-quality private line service on existing multi-party lines, the new Type PLC equipment can be installed in a matter of hours without running additional physical lines and without impairing or interfering with existing services.

The compact, highly adaptable PLC carrier equipment can be used in practically any type of system including manual, automatic, bridged or divided ringing, and magneto. Four channels are available on central office terminals to provide service to up to four private subscribers on any existing party line, at a moment's notice and without mutual interference from any party.

Because the equipment is completely recoverable it is ideal for meeting emergencies or for temporary or seasonal private line service.

## 8-ounce "Floated" Gyro

A miniaturized "floated" gyroscope that weighs only eight ounces, yet will meet the low-drift-rate requirements of short-time or "aided" automatic guidance systems, is being mass-produced by Minneapolis-Honeywell Regulator Co., Aeronautical Division.

Company gyroscope engineers describe the new MIG (miniature integrating gyro) as having the angular momentum of a HIG-5 ($10^5$gm-cm$^2$/sec), the Honeywell integrating gyro. Performance comparable to that of the larger HIG's under unfavorable environments is enclosed in a package weighing less than a half-pound.

Broader potential for the MIG was achieved by a new "systemized" design approach and by developing several new design concepts. These include combining the signal and torque generators into a single dual-microsyn designated as the Dualsyn and placing it at one end of the case with the gimbal at the other.

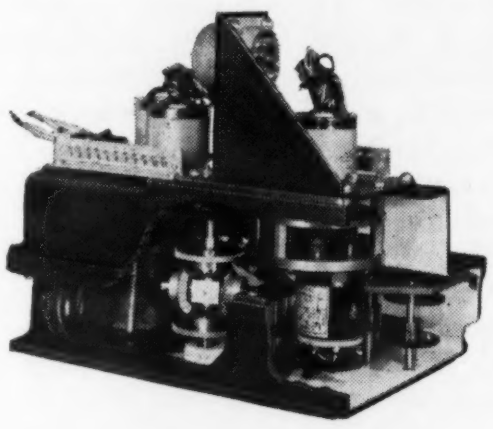
Other design features include reduction of the gimbal suspension pivot to .016-inch, a new method of fluid fill that virtually eliminates balance-shifting air bubbles, a new isoelastic spinmotor and mounting structure that greatly improves performance under vibration, and an improved end bellows that allows flotation fluid changes over a wide range of internal temperatures.

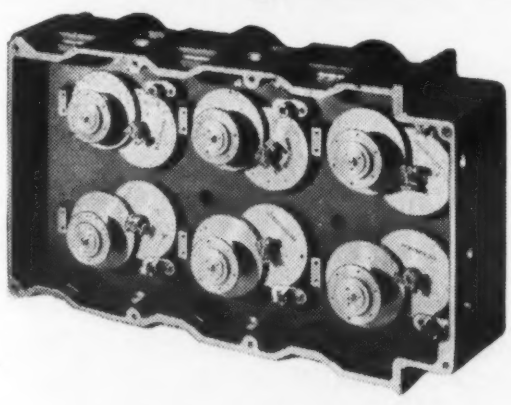
(*Continued on page 76*)

# *Precision-eered*

## ELECTRO-MECHANICAL ASSEMBLIES

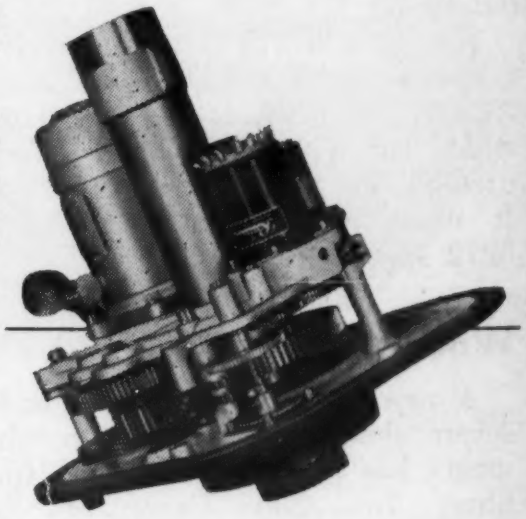
### FROM PILOT STAGE TO PRODUCTION EFFICIENCY





HAVE you a new product on the design boards? Do you have a new contract for radar, missiles, computers or other electro-mechanical devices? Then let Atlas help you from pilot stage to production efficiency.

Atlas experienced production and methods engineers layout the job using new cost-cutting methods, and improved processing techniques. Atlas toolmakers build dies and fixtures to implement these plans. Atlas skilled mechanics and assemblers produce prototypes to your exact specifications *on a job basis*, and can follow thru with production. As many men, machines and hours of work as your electro-mechanical unit requires and no more.



Atlas furnishes the practical engineering step between idea and production line. We've been "precision-eering" on a contract basis for more than a quarter of a century. May we work with you? Write for booklet "Precision-eering Electro Mechanical Equipment." ATLAS Precision Products Co., Philadelphia 24, Pa. (Division of Prudential Industries).

*"From Drawing Board . . . to Production Line"*

# ATLAS

## *Precision Products*

SERVICE ATLAS DEPENDABILITY QUALITY

# NEW PRODUCTS

## Pygmy Connectors

The Scintilla Division of the Bendix Aviation Corp. together with Avnet Eastern Sales, 36 N. Moore St., New York 13, N. Y. and Avnet Western Sales, 8966 National Blvd., Los Angeles 34, Cal., announce the availability of the new Bendix Pygmy Connectors.

In certain shell styles the new miniature aluminum connectors are only ¼ the size and weight of standard AN Connectors. Aircraft gains a distinct advantage from the weight and space saved.

The wide variety of shell styles and insert arrangements offers anywhere from 1 to 55 contacts. All contacts are size 20, heavily gold plated, with machine closed entry sockets.

## Variable Autoformers Designed for Aircraft

The Pacific Division of the United Transformer Corp., 4008 W. Jefferson Blvd., Los Angeles 16, Cal., has announced its new "Vari-Lite" variable autoformers, which have been designed for aircraft.

These UTC aircraft variable autoformers are designed to replace resistive-type light control units with high-efficiency controls of exceptional reliability.

The input is 115 volts, 400 cycles; output is 0 to 28 volts. Typical of the "Vari-Lite" unit is the PA-1028, which has a 4-amp. capacity, measures 2⅜" x 2¾", and weighs 19 oz. It meets MIL-T-9219 and MIL-E-5272 specifications.

## Wheel & Gimbal Gyros

A new rate gyro, accurate under severe shock and vibration requirements, has been introduced by Humphrey, Inc., 2805 Canon St., San Diego, Cal., for missiles.

The model, Series RG03-0100, has a conventional spin axis orientation that allows it to be interchanged with other gyros.

Pivots, bearings, and loose springs have been eliminated by a wheel and gimbal system which permits a standard miniature motor and keeps the static mass of the motor from loading the gimbal.

Among the features of these gyros are high natural frequency, potentiometer pickoffs, pressure-sealed cases, and trouble-free, floating piston, dry air dampers.

Pygmy Connectors, available from Bendix Aviation, have from 1 to 55 contacts.

# New Literature

## Aviation Aspects of 1958 Budget

Excerpts and tables dealing with aviation aspects of the fiscal year 1958 Federal Budget and the accompanying budget message presented to Congress are highlighted in a bulletin release.

Included are discussions of the National Defense policy, the effect of the budget on various military air activities, military Research and Development obligations, and procurement.

Limited copies of the 15-page memorandum are available on request. Ask for "Aviation Aspects of the 1958 Federal Budget," from the Aircraft Industries Association of America, Inc., 610 Shoreham Bldg., Washington 5, D. C.

## Digimatic Automation

From Stromberg Carlson comes word of a new 12-page booklet describing the Digimatic tape control system for machine tools. Digimatic provides automation in a low-cost, fast, economical system that permits one man to handle several magnetic tape controlled machines, each making a different part, if desired. Rapid changeover from one part to another is accomplished in minutes by simply making a new tape.

Tapes are rapidly prepared by using the Digimatic planning desk and a small high-speed special purpose computer.

Small companies can obtain magnetic tapes from a computing center and save the expense of owning and operating their own computer until economies justify the expenditure.

The pamphlet will be sent upon request to the Manager, Applications Engineering, Electronic Control Systems, Inc., 2136 Westwood Blvd., Los Angeles 25, Cal.

## New DuMont Publication

A new quarterly technical journal has replaced the former "Oscillographer," published by Allen B. Du Mont Laboratories, Inc., 750 Bloomfield Ave., Clifton, N. J.

The replacement for the distinguished technical organ is the "Du Mont Instrument Journal." All electronic equipment, including pulse generators, vacuum tube voltmeters, and pulse transformers, as well as oscilloscopes will be covered.

Editorial content will feature articles written by authors all over the globe who are experts in the electronic instrument industry.

## Nickel Cadmium Batteries

To help engineers evaluate the practicability of miniature nickel cadmium storage batteries for electronic, aircraft, and communications equipment, an eight-page technical report describes high output sintered plate batteries. The batteries described are products of the Nickel Cadmium Battery Corp., 66 Pleasant St., Easthampton, Mass.

Copies of the booklet may be obtained by writing to the Company and requesting Bulletin No. 501.

## Civil Defense for Industry

A new Federal Civil Defense Administration publication outlines the steps which industry should take so that, in the event of an enemy attack on the United States, it will be able to resume full scale production as soon as possible.

The technical bulletin provides guidance in planning for emergency leadership, establishing alternate company headquarters, setting up emergency financial arrangements, and providing for alternate suppliers and production methods and an adequate supply of labor.

"Planning for Continuity of Industrial Management Following Disaster" may be obtained from the Federal Civil Defense Administration, Battle Creek, Mich.

# THE RADIO ENGINEERING SHOW

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*SO BIG it takes all 4 floors of New York City's Coliseum to hold this year's great annual IRE Radio Engineering Show. For 4 phenomenal days the largest show ever assembled will open its doors to more than* **41,000** * *engineers just 4 minutes from Times Square.*

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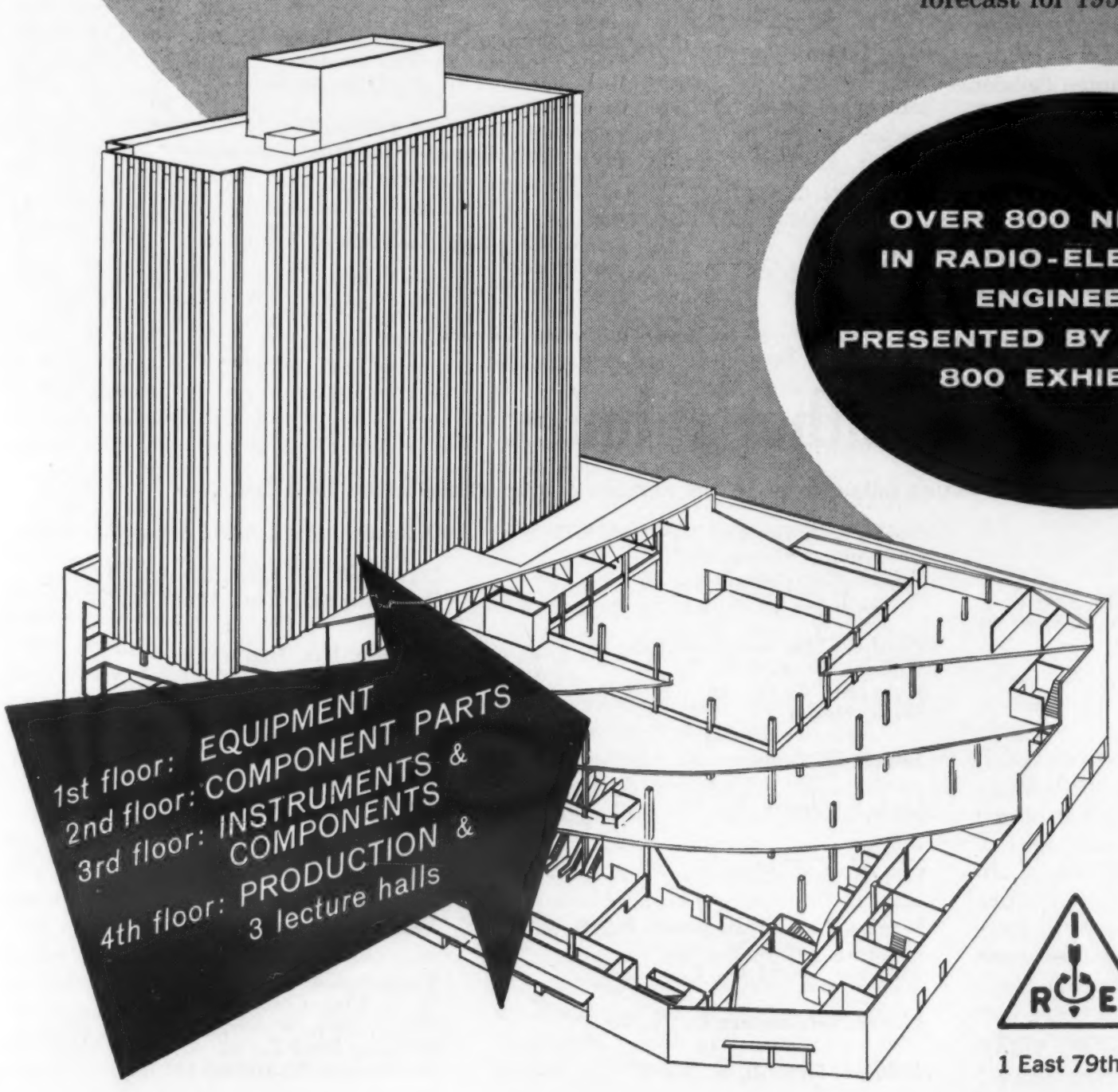


The Institute of Radio Engineers

1 East 79th Street, New York 21, N.Y.

# Index to SIGNAL

## September-October 1955 to July-August 1956

The index for the issues from Volume 1, Number 1 (September-October 1946) through Volume 3, Number 3 (January-February 1949) appears on page 61 of the January-February 1949 issue. The Index for the issues from Volume 3, Number 4 (March-April 1949) through Volume 9, Number 6 (July-August 1955) appears on page 95 of the January-February 1956 issue.



# Author's Index

**The numbers in the listing below refer to the number of the article in the Title Index.**


***ON HUMAN COMMUNICATION: A REVIEW, A SURVEY, AND A CRITICISM, by Colin Cherry. John Wiley & Sons, New York, N. Y. $6.75, 333 pages.***

*On Human Communication* is the introductory volume in a forthcoming series, Studies in Communication. This series, conducted under the auspices of the Massachusetts Institute of Technology, will survey the general field of communication from various points of view including those of the anthropologist, the linguist, the logician, the telecommunications engineer, and the social psychologist.

This volume consists of a series of simple essays. It gives the relations between the diverse studies of communication, of the causes and the growth of this modern interest, together with some idea of the unification which exists.

As the first of the series, this book is a challenge to the intelligent reader. The rest of the volumes, scheduled to appear within the next few years, should be equally provocative and stimulating.

***THE CATHODE RAY OSCILLOSCOPE, CIRCUITRY AND PRACTICAL APPLICATIONS, by J. Czech. Interscience Publishers, Inc., New York, N. Y. $8.50, 340 pages.***

The theory, design, and use of the cathode ray oscilloscope, one of the most versatile instruments in the electronic field, are discussed and explained in this up-to-date text.

Parts I and II of this book are mainly concerned with the structural sections and the mode of operation of the oscilloscope. The circuit descriptions contained in the text are supported by numerous original oscillograms. Part II also deals with the principles which apply when using the oscilloscope in measuring-techniques.

Part III discusses examples of measurements taken from actual practice and methods used for evaluating the results.

A chapter on measurements of television receivers shows how the use of a time base expansion unit allows far greater insight than a normal oscillogram into the details of a signal under investigation.

Directions for building a simplified oscilloscope and a simple time-base expansion unit are contained in Part IV. The circuits described provide an opportunity for considering further details of importance for working with oscilloscopes and for assessing their suitability to perform certain tasks.

As an introduction to the technique of oscillography, this book contributes not only to the advancement of the cathode ray oscilloscope in the field of applied engineering, but also helps promote the application of oscilloscopes in other fields where problems of measurement still await a solution.

***RANDOM PROCESSES IN AUTOMATIC CONTROL, by J. Halcombe Laning, Jr. and Richard H. Battin. McGraw-Hill Book Co., Inc., New York, N. Y. $10.00, 434 pages.***

This text book covers the basic background in the theory of random signals and noise and the practical techniques to be used in the analysis and synthesis of linear control systems which are subjected to random inputs.

The material presented is an outgrowth of a set of lecture notes given by the authors in the Aeronautical Engineering Department at M.I.T., in connection with studies in the M.I.T. Instrument Laboratory. The topics discussed, therefore, have been chosen because of the authors' experiences and interests in the design and analysis of systems in the fields of fire control and navigation.

The first half of the book treats the basic concepts of probability and random time functions. From fundamental ideas, analysis and design techniques are developed for linear control systems made up of both constant and time-varying components. Following most chapters, problems of varying degrees of difficulty are included to test the reader's knowledge of the more important concepts developed in the text.

***TRANSISTOR ENGINEERING REFERENCE HANDBOOK, by H. E. Marrows. John F. Rider Publisher, Inc., New York, N. Y. 288 pages, $9.95.***

This volume is a valuable source book for technical information on transistors and components designed for use with transistors, their operating capabilities, performance characteristics, and sources of supply. Information is assembled and coordinated on the commercial aspects of the transistor industry.

The book is divided into five major sections. The first section deals with the discussion of transistor materials, structures, and fabrication techniques. Coverage is given on point contact, field effect, analog, anti-analog, and other pertinent data.

Section II presents full unabridged information, including characteristic curves and performance data on some two hundred types of commercial transistors in the form of technical specification sheets.

Section III is devoted to components designed for use with transistors. The physical and electrical specifications are listed for many different types of transformers, capacitors, cells and batteries, and a variety of miscellaneous components.

Section IV covers the specifications and, in many cases, the schematics of over a hundred commercial applications of transistorized devices. A directory of transistors and component manufacturers is given in the last section.

***PRINCIPLES OF INSURANCE AND GOVERNMENT BENEFITS; For Service Personnel, by Capt. James M. Garrett, III. Military Service Publishing Co., Harrisburg, Pa. $2.00, 312 pages.***

Every man in uniform will recognize the value of this book as a source of information on all matters relating to family security.

It outlines general programs for officers and men showing the interrelation of the new dependency and indemnity compensation, social security, government insurance, and other government benefits with commercial insurance. Specific programs are illustrated with charts.

The text has been revised extensively to explain the many changes brought about by the recent Survivor's Benefits legislation. This new legislation affects all servicemen of every grade.

The service man who desires to plan adequately for the future security of his family will find this book an indispensable tool.

***L-C OSCILLATORS, by Alexander Schure. John F. Rider Publisher, Inc., New York, N. Y. $1.25, 72 pages.***

Volume 13 of the Electronic Technology Series deals with L-C oscillators. The series offers paper-bound volumes that fall into six groups: electrical bases for electronics, amplification, oscillators and propagation, communication electronics, and electronic engineering fundamentals.

This book includes pertinent items of general information relating L-C oscillators to energy conversion, frequency range, power considerations, series and parallel resonance, and the like. Other chapters study circuit analysis, essential features of oscillator circuits, and low, medium, and high frequency oscillators.

## INDEX TO ADVERTISERS